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SQA MyAlerts Update

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National 5 Skills for Work Energy
Course Specification
(C258 75)
Valid from August 2013
This edition, August 2018, version 3.0

Please refer to the note of changes at the end of this course specification for details of changes from previous version (where applicable).

1
Course outline
Course title:
National 5 Skills for Work Energy
SCQF credit points:
(24 SCQF credit points)
Course code:
C258 75
This course has 3.5 units that are mandatory and a 0.5 unit which is taken from three 0.5 optional units.
Mandatory units
The course comprises the following mandatory units:
J12W 75
Energy: An Introduction
6 SCQF credit points
J12Y 75
Energy: Domestic Wind Turbine Systems
6 SCQF credit points
J130 75
Energy: Domestic Solar Hot Water Systems
6 SCQF credit points
J12X 75

Energy: Employability and Careers
3 SCQF credit points
Optional units
The course comprises the following optional units:
A choice of one from the following options:
J131 75
Energy and the Individual
3 SCQF credit points
J133 75
Energy: Oil/Gas Extraction
3 SCQF credit points
J132 75
Energy: Conventional Technologies and the Grid
3 SCQF credit points
To achieve the course award, the learner must successfully achieve all the mandatory units and one of the optional units.
Recommended entry
Entry is at the discretion of the centre.
Progression
This course, or its units, may provide progression to:
- National Progression Award
- a National Certificate programme in Further Education
- training/employmentOctober 2018, version 3.0

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Core Skills
Achievement of this course gives automatic certification of the following Core Skills component:
Complete Core Skill
Working with Others at SCQF level 4
Core Skill component
Critical Thinking at SCQF level 4
Planning and Organising at SCQF level 4
Working Co-operatively with Others at SCQF level 4
There are also opportunities to develop aspects of Core Skills which are highlighted in the support notes of the unit specifications.
Links to National Occupational Standards
National Occupational Standards (NOS) are developed by the key employment sectors of the United Kingdom. These standards set the competences required for job roles within a particular employment sector.
The NOS for the energy sector (eg Occupational and Functional Map of the UK Renewable Energy Sector) reflect common requirements in the demonstration of competences across that sector.
Some of these competences, which are identified in the current NOS, are reflected to varying

degrees in this course. For example:

- General engineering skills.
- A combination of integrated electrical installation and plumbing skills.
- Mechanical skills.

Additionally, other generic skills included in the NOS are reflected throughout the course including:

- Communication skills.
- Using IT to exchange information.
- Team working skills.
- Ability to learn.
- Ability to follow instructions.
- Organising own learning and development.

Further details are provided in the 'Rationale' section.

Equality and inclusion

This Course Arrangements Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.October 2018, version 3.0

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Common rationale for Skills for Work Courses

Skills for Work Courses are designed to help learners to develop:

- Skills and knowledge in a broad vocational area.
- Skills for learning, skills for life and skills for work.
- Core Skills.
- An understanding of the workplace.
- Positive attitudes to learning.
- Skills and attitudes for employability.

A key feature of these courses is the emphasis on *experiential learning*. This means learning through practical experience and learning by reflecting on experience.

Learning through practical experience

Teaching/learning programmes should include some or all of the following:

- Learning in real or simulated workplace settings.
- Learning through role play activities in vocational contexts.
- Carrying out case study work.
- Planning and carrying out practical tasks and assignments.

Learning through reflecting at all stages of the experience

Teaching/learning programmes should include some or all of the following:

- Preparing and planning for the experience.
- Taking stock throughout the experience, reviewing and adapting as necessary.
- Reflecting after the activity has been completed, evaluating and identifying learning points.

The Skills for Work courses are also designed to provide learners with opportunities for developing *Core Skills*, and *Skills for Learning, Skills for Life and Skills for Work* with a focus on enhancing skills and attitudes for *employability*.October 2018, version 3.0
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Core Skills
The five Core Skills are:

- Communication
- Numeracy
- Information and Communication Technology (ICT)
- Problem Solving
- Working with Others

Employability
The skills and attitudes for employability, including self-employment, are outlined below:

- Generic skills/attitudes valued by employers.
- Understanding of the workplace and the employee's responsibilities, for example, timekeeping, appearance, customer care, etc.
- Self-evaluation skills.
- Positive attitude to learning.
- Flexible approaches to solving problems.
- Adaptability and positive attitude to change.
- Confidence to set goals, reflect and learn from experience.
- Specific vocational skills/knowledge.

Course specifications highlight the links to NOS in the vocational area and identify progression opportunities.
Opportunities for developing these skills and attitudes are highlighted in each of the course and unit specifications. These opportunities include giving young people direct access to workplace experiences or, through partnership arrangements, providing different learning environments and experiences which simulate aspects of the workplace. These experiences might include visits, visiting speakers, role play and other practical activities.
A Curriculum for Excellence (Scottish Executive 2004) identifies aspirations for every young person. These are that they should become:

- successful learners
- confident individuals
- responsible citizens
- effective contributors

The learning environments, the focus on experiential learning and the opportunities to develop employability, Skills for Learning, Skills for Life, Skills for Work and Core Skills in these courses contribute to meeting these aspirations.October 2018, version 3.0
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Course rationale for National 5 Skills for Work
Energy
All new and revised National Courses reflect Curriculum for Excellence values, purposes and

principles. They offer flexibility, provide more time for learning, more focus on skills and applying learning, and scope for personalisation and choice.
In this course, and its component units, there will be an emphasis on skills development and the application of those skills. Assessment approaches will be proportionate, fit for purpose and will promote best practice, enabling learners to achieve the highest standards they can.
This Skills for Work course is also designed to provide learners with opportunities for developing Core Skills and Skills for Learning, Skills for Life and Skills for Work, with a strong focus on enhancing skills and attitudes for employability.
This course is intended to equip learners with the necessary knowledge and skills which will enhance their prospects for employment in the wide range of opportunities within energy sectors. The course will allow learners to develop a range of employability skills which are of particular relevance to energy industries. Core Skills of Information and Communication Technology and Problem Solving will also be developed throughout the course where opportunities arise. The course will offer a variety of approaches to learning and teaching and will include a strong element of experiential learning. It is intended that some of the course will be delivered and assessed in a different learning environment to that of the school through a partnership arrangement with a college, training provider, or employer.
There are many technologies used in the production of energy and this course has been designed to contain both an electrical generation practical/skills element using wind turbines and a heat generation practical/skills element using solar panels. These elements were selected to ensure learners receive a range of skills using different technologies that are involved in the generation of energy. Other systems used to generate energy from both the traditional/conventional and renewable systems will be discussed and evaluated during the course.
The general aims of the course are to:
♦ Widen participation in vocationally-related learning for 14–16 year olds.
♦ Allow learners to experience vocationally-related learning.
♦ Provide learners with a broad introduction to the energy sector.
♦ Allow learners the opportunity to develop skills relevant to the microgeneration energy sector.
♦ Develop the learners’ engineering skills.
♦ Encourage learners to evaluate the impact of energy generation on the environment.
♦ Encourage learners to foster a good work ethic, including timekeeping, a positive attitude and other relevant employability skills.
♦ Provide opportunities to develop a range of core skills in a realistic context.
♦ Encourage learners to take charge of their own learning and development.
♦ Provide a range of teaching, learning, and assessment styles to motivate learners to achieve their full potential.
♦ Facilitate progression to further education and/or training.October 2018, version 3.0
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In particular, the aims of the course are to:
♦ Encourage learners to consider a career in the energy sector.

♦ Develop an awareness of the role of conventional and renewable energy systems in the UK.

♦ Develop an awareness of what opportunities there may be within the sector in terms of the types and range of career options.

♦ Provide learners with knowledge and skills which are directly relevant to employment within the energy sector, eg solar hot water and wind turbines.

♦ Provide opportunities for the personal development of skills and attitudes that will improve the learners' employment potential within the energy sector.

♦ Develop the learners' awareness of their individual strengths and weaknesses in relation to the requirements of the sector, and to reflect on how this affects their employability potential.

♦ Raise awareness of the impact of the energy sector on the environment.

♦ Raise awareness of the responsibilities of the energy industry with regard to the environment.

Purposes and aims of the course

The general aims of the course are to:

♦ Widen participation in vocationally-related learning for 14–16 year olds.

♦ Allow learners to experience vocationally-related learning.

♦ Provide learners with a broad introduction to the energy sector.

♦ Allow learners the opportunity to develop skills relevant to the microgeneration energy sector.

♦ Develop the learners' engineering skills.

♦ Encourage learners to evaluate the impact of energy generation on the environment.

♦ Encourage learners to foster a good work ethic, including timekeeping, a positive attitude and other relevant employability skills.

♦ Provide opportunities to develop a range of core skills in a realistic context.

♦ Encourage learners to take charge of their own learning and development.

♦ Provide a range of teaching, learning, and assessment styles to motivate learners to achieve their full potential.

♦ Facilitate progression to further education and/or training.October 2018, version 3.0
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In particular, the aims of the course are to:

♦ Encourage learners to consider a career in the energy sector.

♦ Develop an awareness of the role of conventional and renewable energy systems in the UK.

♦ Develop an awareness of what opportunities there may be within the sector in terms of the types and range of career options.

♦ Provide learners with knowledge and skills that are directly relevant to employment within the energy sector, eg solar hot water and wind turbines.

♦ Provide opportunities for the personal development of skills and attitudes that will improve the learners' employment potential within the energy sector.

♦ Develop the learners' awareness of their individual strengths and weaknesses in relation

to the requirements of the sector, and to reflect on how this affects their employability potential.

- Raise awareness of the impact of the energy sector on the environment.
- Raise awareness of the responsibilities of the energy industry with regard to the environment.

Information about typical learners who might do the course

The primary target group for this course is school learners in S3 and S4. However, the course is also suitable for S5/S6 learners and adult learners who are seeking to enhance their employability and vocational skills in the energy sector.October 2018, version 3.0
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Course structure and conditions of award

Summary of course content

Learners will explore a variety and range of industries and career opportunities which exist within the energy sector. Learners will become familiar with key words and terms used in the sector, and will develop an awareness of the impact of the energy sector on the environment and individual lives. Personal development of employability skills will be the main focus across the course with each unit aiming to enhance such skills. The development of teamwork and practical skills and carrying out test procedures are also given high profile.
The mandatory units in this course introduce the various energy industries based in the UK, develop practical skills by building a small scale solar hot water system and wind turbine, and learners will also review their employability skills and evaluate their strengths and weaknesses. There is an opportunity to specialise in one subject area by selecting one of the three optional units, ie analyse their own carbon footprint or develop a deeper knowledge of oil and gas production in the North Sea or develop further knowledge on the conventional energy generation systems used in the UK.

Summary of unit content

Units are statements of standards for assessment and not programmes of learning and teaching. They can be delivered in a variety of ways; however Skills for Work units are designed to provide an experiential learning process.

Energy: An Introduction (National 5) — Mandatory

The aim of the unit is to provide learners with an overview of where we get our energy from, the engineering systems that convert it into a more convenient form, and the energy conversion processes that take place from fuel being input to energy being generated.
It gives a broad overview of traditional and renewable energy systems, energy conservation and includes an evaluation of an industrial or domestic energy generation facility.
Investigation and presentation skills are developed in this unit.

Energy: Domestic Solar Hot Water Systems (National 5) — Mandatory

The unit introduces a microgeneration system which generates heat from solar energy and transfers this heat energy to a heat exchanger and on to other appliances, eg hot water tank or under-floor heating system suitable for use in a domestic or small scale industrial building.
This is a practical skills based unit which gives students the practical skills to manufacture some of the parts and assemble a small solar hot water panel through team working which is seen as an essential element in this unit.

Energy: Domestic Wind Turbine Systems (National 5) — Mandatory

This unit introduces residential or microgeneration wind turbine systems which generate electrical energy. This is a practical skills based unit which will give students the ability to wire up an electrical circuit, manufacture parts, assemble, and test a small scale wind turbine. The learners will use prepared components to build the turbine. Team working is seen as an essential element in this unit.

Energy: Employability and Careers (National 5) — Mandatory

Learners will review their performance in the employability skills undertaken in significant practical activities in the units throughout the course and evaluate their own strengths and weaknesses. It will also involve students investigating careers and job roles within the energy sector.October 2018, version 3.0

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Energy and the Individual (National 5) — Optional

Learners will investigate the energy they use over an average year. This will include producing their own carbon footprint. From the data gained, they will review and evaluate their lifestyles to try and reduce the energy they consume and thereby reduce the size of their carbon emissions/footprint. Presentation skills will also be developed in this unit.

Energy: Oil/Gas Extraction (National 5) — Optional

Learners will be introduced to the formation of oil and gas fields and the sustainability of these fields, and the type of platform construction used on offshore installations. The methods used to extract oil and gas including drilling, mud, and fluid control will also be investigated.

Energy: Conventional Technologies and the Grid (National 5) — Optional

Learners will investigate how conventional energy generation plants support the UK's total energy needs and review the effect each of them has on the environment. They will investigate systems used to generate electricity using coal, oil, gas, hydro, and nuclear energy as a power source. The national grid and the distribution of energy/power will be investigated from both present, and projected, future needs.

Conditions of award

To achieve the award of National 5 Skills for Work Energy, learners must achieve all the required units as outlined in the course outline. They will be assessed pass/fail within centres. Skills for Work Courses are not graded. October 2018, version 3.0

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Assessment

Assessment objectives

The aim of the assessment in this course is to provide opportunities to gather evidence of development in:

- practical skills
- review and evaluation skills
- investigation skills
- knowledge and understanding

Unit assessment

The assessment of the units in this course will be as follows:

Unit title
Assessment
Mandatory units
Energy: An Introduction (National 5)
outcome 1, outcome 2 and outcome 3 —
investigation
outcome 4 — group presentation
Energy: Domestic Solar Hot Water Systems
(National 5)
outcome 1 individual practical exercises
outcome 2 and outcome 3 — teamwork
practical exercise
outcome 4 — presentation
Domestic Wind Turbine Systems (National 5) outcome 1 and outcome 2 — individual
practical exercises
outcome 3 and outcome 4 — teamwork
practical exercise
outcome 5 — presentation
Energy: Employability and Careers
(National 5)
outcome 1 — review and evaluation
outcome 2 — presentation
Unit title
Assessment
Optional units
Energy and the Individual (National 5)
outcome 1 and outcome 2 — investigation
outcome 3 — presentation
Energy: Oil/Gas Extraction (National 5)
outcome 1 and outcome 2 — investigation
outcome 3 — presentation
Energy: Conventional Production
Technologies and the Grid (National 5)
outcome 1 and outcome 2 — investigation
outcome 3 — presentation
It is the intention that the necessary skills and attitudes being developed in this course are assessed through the learners' involvement in a range of practical activities, however, there are also elements of knowledge and understanding which are important. An important element in the assessment process will be the ability of the learner to review progress and development throughout the course. Where possible, assessment should reflect current workplace practice, whether demonstrated through work placement, or simulated environments.October 2018, version 3.0
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Unit assessment

Further details about unit assessment for this course can be found in the unit specifications and the assessment support materials.

Exemplification of possible assessment approaches for these units will be provided in the assessment support pack.

Quality assurance

All instruments of assessment used within this course should be internally verified, using the appropriate policy within the centre and the guidelines set by SQA.

External verification will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

Further information on internal and external verification can be found in *SQA's Guide to Assessment* (www.sqa.org.uk/GuideToAssessment).October 2018, version 3.0

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Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this course. The skills that learners will be expected to improve on and develop through the course are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the course where there are appropriate opportunities.

1

Literacy

1.1 Reading
1.2 Writing
1.3 Listening and talking

3

Health and Wellbeing

3.1 Personal learning
3.2 Emotional wellbeing
3.4 Planning for, and making, choices and changes

4

Employability, enterprise and citizenship

4.1 Employability
4.3 Working with others
4.4 Enterprise

5

Thinking Skills

5.1 Remembering
5.2 Understanding
5.3 Applying
5.4 Analysing and evaluating
5.5 Creating

Amplification of these skills is given in SQA's *Skills Framework: Skills for Learning, Skills for*

Life and Skills for Work. The level of these skills will be appropriate to the level of the course.October 2018, version 3.0
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Employability skills profile

In addition to the specific vocational skills developed and assessed in this course, employability skills are addressed as detailed in the table below. For the purposes of the table, the units are referred to as A, B, C and D as indicated.

Energy: Introduction — mandatory
= A
Energy: Domestic Solar Hot Water Systems — mandatory
= B
Domestic Energy Systems: Wind Turbine Systems — mandatory
= C
Energy: Employability and Careers — mandatory
= D
Energy and the Individual — optional
= E
Energy: Oil/Gas Extraction — optional
= F
Energy: Conventional Production Technologies and the Grid — optional
= G

Employability skill/attitude

Evidence

♦ Maintaining good timekeeping and attendance
A, B, C, D, E/F/G
♦ Maintaining a tidy workplace
B, C
♦ Seeking feedback and advice
A, B, C, D, E/F/G
♦ Following instructions
B, C
♦ Working co-operatively with others
A, B, C
♦ Selecting and using tools correctly and for the purpose they were designed
B, C
♦ Using Personal Protective Equipment correctly and working safely
A, B, C
♦ Following basic drawings correctly
B, C
♦ Checking quality of work
A, B, C, D, E/F/G

- ♦ Working to agreed deadlines

A, B, C, D, E/F/G

- ♦ Organising work effectively

A, B, C, D, E/F/G

- ♦ Working confidently

A, B, C, D, E/F/G

- ♦ Willingness to learn new skills or techniques

B, C

- ♦ Working independently

A, B, C, D, E/F/G

- ♦ Reflecting on own performance

B, C

- ♦ Learning from past experiences

B, C

- ♦ Awareness of a range of careers and job roles

D

- ♦ Developing investigation skills

A, D, E/F/G

- ♦ Developing presentation skills

A, B, C, D, E/F/G

- ♦ Developing creativity skills

A, B, C, D, E/F/G

Assessment evidence in all units:

Learner folio of performance and product evidence in response to a given brief, supported by assessor checklists.October 2018, version 3.0

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Course support notes

Course support notes are not mandatory; they provide advice and guidance on approaches to delivering and assessing the Skills for Work course. They are intended for teachers and lecturers who are delivering the course and its units.

Guidance on approaches to delivery and assessment for this course

Centres should ensure that an induction to the course is given which will enable learners to understand fully what is required and the approaches to be adopted. It is important that employability skills, both generic and specific to the energy industries, are stressed at this time.

Sequencing/integration of units

While the sequence of delivery of the units is for individual centres to decide, it is recommended that *Energy: An Introduction* (National 5) unit is offered first. This unit sets the scene for the other units to be delivered in the context of the energy sector and the energy people use. All teachers, lecturers and assessors involved in the delivery and assessment of this course should have an appreciation of the nature and content of the whole course. This

is particularly important in the delivery of the *Energy: Employability and Careers* (National 5) unit. It is intended that the evidence requirements for this unit will be drawn from the other units in the course.

Guidance on approaches to delivery

The course has been designed to ensure that learners learn through practical experiences where possible. The main focus in each of the skills specific units is on practical work. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical engineering activities within the units.

Energy: An Introduction (National 5) includes practical lab work where learners will gain a greater understanding of the principles of energy conversion and how we can generate more useful forms of energy that can be used in a range of energy production processes.

Learners should be encouraged to investigate energy related topics, including careers, within the energy sector, and the effect energy production has on the environment or climate change.

Health and safety is integral to all practical tasks and should be emphasised at the start of, and throughout, each lesson. Brief lessons on workshop protocol should also be included at the start of the practical units and at appropriate points during these units.

Teaching and learning approaches will include demonstrations of practical work by tutors. Short lessons on specific aspects of industrial practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the learners practise the skill emphasised by the demonstration.

Given the practical nature of teaching/learning and assessment, centres should ensure that teaching blocks are of sufficient time to allow a meaningful experience for learners.

Reflecting on practical experiences and learning from them is an approach that is embedded in the course. Throughout the learning experiences, the emphasis should be on helping learners to develop an awareness of the employability skills and attitudes needed for the energy industry, for example, good timekeeping, co-operating with others, team working,

taking instructions, and a positive attitude to learning. Opportunities to develop these skills and attitudes arise naturally in the work during the course. Learners should be aware that these generic skills are just as important as the practical skills they are developing. For example, it is important for workshop activities to be carried out to effective schedules; learners will have opportunities to demonstrate good timekeeping in the context of these schedules. Learners will have to co-operate with others regarding shared workspace, tools and equipment. They will have to co-operate and communicate regarding the transfer of materials, tools, and equipment safely around and across the workshop. Learners will be encouraged to develop a positive attitude to reducing waste and reduce their impact on the environment with regard to the use of materials and the consumption of energy.

Teaching and learning approaches should encourage learners to take responsibility for their own learning and development. In the practical units of the course, learners need to carry out quality checks on their own work. This provides a good opportunity to motivate learners to take pride in their work. The integration of employability skills, in particular self-evaluation

skills, will allow learners to take responsibility for seeking feedback and identifying action points for improvement in their own performance. This should help to develop confidence in taking advice and in asking for direction and assistance where necessary.
Investigations are used throughout this course and lecturing staff should encourage learners to use as many methods as possible to gain the information they need. Apart from the teaching notes provided, learners should make full use of the internet, journals (online and paper-based), books, national and local papers, friends or family who have knowledge or experience of the energy sector, site visits, practical demonstrations, and experimentation.
Presentations are also frequently used in this course. Learners should be encouraged to use their creativity skills to develop a range of skills in presenting information, this could include a talk, flipcharts, whiteboard (electronic), computer software, practical demonstrations, digital pictures, video clips (using a mobile phone or camcorder).
Teaching staff should emphasise the need for learners to try and develop their own ideas to solve problems or issues; these can then be used as points for discussion. Giving learners the solution should not be seen as the first option. Learners should be encouraged to play an active part in their own learning by discussing their views and thoughts on the technologies being used, the environment, careers and personal preferences with peers and teaching staff.

Guidance on approaches to assessment

Throughout the course, the need for correct preparation for practical activities should be stressed. However, such preparation should not take excessive time to complete. Teaching correct skills practice, effective and safe use of tools and equipment, and a positive view of health and safety should help to ensure that preparation for practical work is comprehensive.
Learners will require supervision during practical work — both on a skills level and for health and safety reasons. The learning environment should be designed to minimise risks and provide a safe context for carrying out tasks. For example, when undertaking the task of soldering, learners should be made aware of the risk from heat and fumes to themselves and others.
It is recommended that each practical session be preceded by a ‘tool box’ talk on an aspect of health and safety relevant to the work in hand. It is recommended that learners be given regular but short practice sessions in the correct and safe working principles of the materials to be used in each session, as well as coaching in the correct use of associated tools and equipment.October 2018, version 3.0
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Centres are encouraged to establish links with local industry. Local engineering companies, trades associations, Sector Skills Councils (SSCs) and Engineering or Energy Institutes may be prepared to offer support, for example, in the form of visits from representatives of their organisations. Visitors from the energy industry will be able to give learners a realistic view of jobs and conditions within the energy sector.
Centres should try and arrange a visit to an energy generation facility as part of the learners’ learning experience and assessment. Visits to local sites are often particularly useful to give learners a feel for the environment, equipment, and staff working and using energy generation systems.

Site visits should be carefully arranged, organised and authorised. Due regard should be placed on insurance arrangements, necessary when taking students on these visits, particularly when going on to industrial sites.

Teaching and learning approaches should impart enthusiasm and help to inform learners of realistic prospects in the energy industries. They should become aware of steps to employment or further training. Through their experiences of the various practical skills and knowledge of various energy systems in the course, they should become better equipped to make valid personal choices regarding careers and further study.

A holistic approach to the course delivery and assessment should be adopted. The types of energy generation methods and plant/systems contained within the *Energy: An Introduction* (National 5) unit should form the basis of the practical units *Energy: Domestic Wind Turbine Systems* (National 5) and *Energy: Domestic Solar Hot Water Systems* (National 5). *Energy: Employability and Careers* (National 5) unit should be central to the whole course and delivered alongside the other units.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this course. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core Skills

Learners will be encouraged to learn through practical activity with workshop skills, and practical lab work, forming a main type of delivery. The development of Core Skills and employability skills should be uppermost in the minds of those considering how to plan lessons. Learners should be encouraged to accept responsibility for learning and ownership of the review and self-evaluation process. The *Energy: Employability and Careers* (National 5) unit, in particular, will actively encourage learners to analyse their strengths and weaknesses with regard to the employability skills identified within the course units and review their own performance through self-reflection and self-evaluation. Tasks involving investigations into energy systems and the effects these energy systems have on individuals or the environment should be incorporated throughout the course. This approach will encourage development in the use of information technology as a tool for information gathering and analysis, independent working, and investigation skills.October 2018, version 3.0

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Opportunities to develop aspects of Core Skills should be used where they arise naturally. For example, in order to carry out activities in a workshop environment, learners will develop aspects of numeracy when making calculations and taking measurements. They will also have to communicate simple science/engineering/construction terms with tutors and fellow learners regarding skills practices, materials and tools, health and safety, and working together in the workplace. They will have to work in a team during the practical units; it is

important that they realise what the positive attitudes are to ensure good team working dynamics. Aspects of Problem Solving will arise through their participation in practical work. This course gives automatic certification of Working with Others at SCQF level 4, Critical Thinking at SCQF level 4, and Planning and Organising at SCQF level 4.October 2018, version 3.0

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General information for learners

The National 5 Skills for Work Energy course is an introduction to the various energy industries based in the UK. You will also develop practical skills by building a small scale solar hot water system and wind turbine, review your employability skills and evaluate your own strengths and weaknesses.

There is an opportunity to specialise in one subject area by selecting one of the three specialist areas to study:

- analyse your own carbon footprint
- develop a deeper knowledge of oil and gas production in the North Sea
- develop further knowledge on the conventional energy generation systems used in the UK

The primary target group for this course is school learners in S3 and S4. However, it is also suitable if you are an S5/S6 learner, or an adult learner wanting to increase employability and vocational skills in the energy sector.

Once you have finished this course, you may progress to:

- a National Progression Award
- a National Certificate programme in Further Education
- training/employmentOctober 2018, version 3.0

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Administrative information

Published:

October 2018 (version 3.0)

History of changes to national course specification

Version

Description of change

Date

2.0

2013 — course re-coded as part of CfE development programme but no change to course and unit content.

August 2013

3.0

Course specification moved to a new template. No change to content. Units re-coded to align with corresponding course 2 code.

October 2018

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National Qualifications 2019

Qualification Verification Summary Report

Skills for Work: Energy

The purpose of this report is to provide feedback to centres on verification in National Qualifications in this subject.

Skills for Work Courses

Skills for Work: Energy (National 5)

General comments

This session saw an increase in the number of centres offering this award. All the newly-approved centres were schools and it appears that the 're-branding' of the award as 'National 5 Energy' was a significant factor in the increase.

Course arrangements, unit specifications, instruments of assessment and exemplification materials

The majority of the assessments used were from the assessment support packs, or localised adaptations of these. In all cases where adaptions had been made, these were appropriate and assessments remained valid.

Evidence requirements

At each of the four centres visited, candidate evidence that was reviewed met the requirements of the unit specifications. Evidence was presented in the form of physical artefacts, paper documents and electronic submissions.

Administration of assessments

Assessments had been administered correctly and all assessment and internal verification judgements were valid for the samples reviewed.

Centres have been utilising appropriate practices and documentation to administer and record their internal verification activity.

Areas of good practice

- Internal verification processes supported by course documents including a course verification plan with a checklist of required actions and associated comments.
- Innovation in the use of resources required to deliver the award successfully — for example, the use of component kits to facilitate efficient assembly work by candidates.
- Up-cycling of discarded materials for the construction element of the Domestic Wind Turbine module.
- The use of an online calculator to assist candidates evaluate their own carbon footprint helps reinforce the significance of the environmental impact of individuals.

2

National 4 Skills for Work
Engineering Skills Course
Specification
(C243 74)
Valid from August 2013

This edition, October 2018, version 3.0

Please refer to the note of changes at the end of this course specification for details of changes from previous version (where applicable).

1

Course outline

Course title:
National 4 Skills for Work Engineering Skills

SCQF credit points:
(24 SCQF credit points)

Course code:
C243 74

Mandatory units

The course comprises the following mandatory units:

J16F 74
Engineering Skills: Mechanical
6 SCQF credit points
J16G 74
Engineering Skills: Electrical/Electronic
6 SCQF credit points
J145 74
Engineering Skills: Fabrication
6 SCQF credit points
J144 74
Engineering Skills: Manufacture and Assembly 6 SCQF credit points

Recommended entry

Entry to this course is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by the following or equivalent qualifications and/or experience:

- an interest in engineering
- an ability to work in numeracy and literacy at SCQF level 3
- some aptitude for graphical forms of communication

In terms of prior learning and experience, relevant experiences and outcomes may also

provide an appropriate basis for doing this course.

Progression

This course or its components may provide progression to:

- ♦ Scottish Progression Award in Engineering (National 5)
- ♦ SVQs and Modern Apprenticeships in Engineering areas
- ♦ further study, employment and/or trainingOctober 2018, version 3.0

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Core Skills

Achievement of this course gives automatic certification of the following Core Skills component:

Core Skill component

Critical Thinking at SCQF level 4

There are also opportunities to develop aspects of Core Skills which are highlighted in the support notes of this unit specification.

Links to National Occupational Standards

National Occupational Standards (NOS) are developed by the key employment sectors of the United Kingdom. These standards set the competences required for job roles within a particular employment sector.

The National 4 Skills for Work Engineering Skills course has been designed to link broadly to NOS, but the standards required of first-year apprentices in the engineering industry are significantly more onerous than those in this course.

Compared to NOS, this course requires either reduced scale and complexity, or more achievable tolerances, and therefore provides a useful preparation for employment or further training in the engineering industry. The general tolerance required for the practical activities in this course should be ±3mm. The specific tolerances required for practical unit assessments are specified in the assessment support packs (ASPs).

Further details are provided in the 'Rationale' section.

Equality and inclusion

This Course Arrangements Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.October 2018, version 3.0

3

Common rationale for Skills for Work Courses

Skills for Work Courses are designed to help learners to develop:

- ♦ skills and knowledge in a broad vocational area
- ♦ skills for learning, skills for life and skills for work
- ♦ Core Skills
- ♦ an understanding of the workplace
- ♦ positive attitudes to learning
- ♦ skills and attitudes for employability

A key feature of these courses is the emphasis on *experiential learning*. This means learning through practical experience and learning by reflecting on experience.

Learning through practical experience

Teaching/learning programmes should include some or all of the following:

- ♦ learning in real or simulated workplace settings
- ♦ learning through role play activities in vocational contexts
- ♦ carrying out case study work
- ♦ planning and carrying out practical tasks and assignments

Learning through reflecting at all stages of the experience

Teaching/learning programmes should include some or all of the following:

- ♦ preparing and planning for the experience
- ♦ taking stock throughout the experience, reviewing and adapting as necessary
- ♦ reflecting after the activity has been completed, evaluating and identifying learning points

The Skills for Work Courses are also designed to provide learners with opportunities for developing *Core Skills*, and *Skills for Learning, Skills for Life and Skills for Work* with a focus on enhancing skills and attitudes for *employability*.October 2018, version 3.0

4

Core Skills

The five Core Skills are:

- ♦ Communication
- ♦ Numeracy
- ♦ Information and Communication Technology (ICT)
- ♦ Problem Solving
- ♦ Working with Others

Employability

The skills and attitudes for employability, including self-employment, are outlined below:

- ♦ generic skills/attitudes valued by employers
- ♦ understanding of the workplace and the employee's responsibilities, for example, time keeping, appearance, customer care, etc
- ♦ self-evaluation skills
- ♦ positive attitude to learning
- ♦ flexible approaches to solving problems
- ♦ adaptability and positive attitude to change
- ♦ confidence to set goals, reflect and learn from experience
- ♦ specific vocational skills/knowledge

Course specifications highlight the links to NOS in the vocational area and identify progression opportunities.

Opportunities for developing these skills and attitudes are highlighted in each of the course and unit specifications. These opportunities include giving young people direct access to workplace experiences or, through partnership arrangements, providing different learning environments and experiences which simulate aspects of the workplace. These experiences

might include visits, visiting speakers, role play and other practical activities.
A Curriculum for Excellence (Scottish Executive 2004) identifies aspirations for every young person. These are that they should become:

- successful learners
- confident individuals
- responsible citizens
- effective contributors

The learning environments, the focus on experiential learning and the opportunities to develop employability, Skills for Learning, Skills for Life, Skills for Work and Core Skills in these courses contribute to meeting these aspirations.October 2018, version 3.0
5

Course rationale for National 4 Skills for Work
Engineering Skills

All new and revised National Courses reflect Curriculum for Excellence values, purposes and principles. They offer flexibility, provide more time for learning, more focus on skills and applying learning, and scope for personalisation and choice.
In this course, and its component units, there will be an emphasis on skills development and the application of those skills. Assessment approaches will be proportionate, fit for purpose and will promote best practice, enabling learners to achieve the highest standards they can.
This Skills for Work course is also designed to provide learners with opportunities for developing Core Skills and Skills for Learning, Skills for Life and Skills for Work, with a strong focus on enhancing skills and attitudes for employability.
The National 4 Skills for Work Engineering Skills course has been designed to provide a basis for progression into further education or for moving directly into training in employment
within an engineering sector. The overall purpose of the course is to ensure that learners start to develop the generic and practical skills, knowledge and understanding and employability skills needed within an engineering sector.
The engineering sector includes the following:
Mechanical
Manufacture
Maintenance
Fabrication
Welding
Electrical
Electronic
Foundry
Automotive
Servicing
Transport
Aeronautical
Communications
Space

Energy generation
Conservation
Marine
Water
Salination
Oil/Gas
Petroleum
This course focuses on the four broad areas of mechanical, electrical/electronic, fabrication and manufacture. This will allow the learners to gain basic transferable skills which can be applied to any of the above engineering areas.

Purposes and aims of the course

The general aims of this course are to:

- Widen participation in vocationally-related learning for school learners from S3 upwards.
- Allow learners to experience vocationally-related learning.
- Provide learners with a broad introduction to the engineering vocational sector.
- Encourage learners to foster a good work ethic, including time-keeping, a positive attitude
and other relevant employability skills.
- Provide opportunities to develop a range of Core Skills in a vocational context.
- Encourage learners to take charge of their own learning and development.
- Provide a range of teaching, learning and assessment styles to motivate learners to achieve their full potential.
- Facilitate progression to further education and/or training.
- Encourage learners to plan their work and review their progress.
- Encourage learners to develop a positive attitude to waste minimisation and environmental issues.October 2018, version 3.0

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In particular, the aims of the National 4 Skills for Work Engineering Skills course are to:

- Encourage learners to consider a career in the engineering industry.
- Develop an awareness of the opportunities there may be within engineering in terms of the types and range of career options.
- Enable learners to develop and apply practical, technical and communication skills as a foundation for future learning and progression.
- Develop the learners' awareness of their individual strengths and weaknesses in relation to the requirements of engineering, and to reflect on how this affects their employability potential.
- Give learners the technical knowledge, skills and understanding associated with a range of skills in engineering at this level.
- Encourage learners to apply their knowledge and understanding of engineering by using skills of evaluation and problem solving in a vocational context.
- Develop an awareness that health and safety issues are integral to the world of work generally and engineering in particular.

- Prepare learners for further learning opportunities, study and training for employment in engineering and related occupations.

Information about typical learners who might do the course

The primary target group for this course is school learners in S3 and above. This course is designed at a level and scope such that it can be delivered in schools, if the school has suitable facilities and teaching expertise.

Due to the specialist expertise and facilities available in further education colleges and with training providers, it is anticipated that the course will rely on, and build on, existing partnerships between schools, further education colleges, training providers and employers, A partnership approach will enable the course to be delivered in a variety of appropriate learning environments enhancing the learning experience.

The course is also suitable for adult learners who are seeking to enhance their employability and develop introductory vocational skills in an engineering sector.October 2018, version 3.0
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Course structure and conditions of award

Summary of course content

This course comprises four 40-hour units. The content of the course focuses on the development of basic hand skills across the disciplines of mechanical, electrical/electronic, fabrication and manufacture and assembly. Central to the content are the generic employability skills valued by employers in an engineering sector. These skills are developed in each of the four units and are assessed at least twice during the course. These add value to the development of the specific vocational skills.

All the engineering skills units, while focusing on specific skill areas, also address generic skills related to:

- engineering communications
- engineering materials
- measurement and marking
- working to tolerances
- Core Skills

The engineering skills units also include employability skills outlined below:

- time-keeping and attendance
- positive attitudes to learning
- responding positively to advice and feedback
- following instructions
- working co-operatively with others
- health and safety awareness
- necessary preparation planning
- checking own work
- problem solving

Summary of unit content

Units are statements of standards for assessment and not programmes of learning and teaching. They can be delivered in a variety of ways; however Skills for Work units are

designed to provide an experiential learning process.

Engineering Skills: Mechanical (National 4)

This unit is designed to be the first attempted on the course. Learners are required to select the correct tools and materials required to safely manufacture an artefact. During the manufacture, learners will read simple engineering drawings, measure and mark, select appropriate materials and work to specified tolerances. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.

Engineering Skills: Electrical/Electronic (National 4)

In this unit learners will select the correct tools and components required to construct a basic functional extra low voltage electrical/electronic circuit from a given diagram and specification. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.October 2018, version 3.0

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Engineering Skills: Fabrication (National 4)

In this unit learners will select the correct tools, materials and equipment required to manufacture an artefact using cutting, hot and cold forming and mechanical and thermal joining techniques. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.

Engineering Skills: Manufacture and Assembly (National 4)

This unit is designed to be attempted only after successful completion of the preceding skills units. Learners will select and safely use the correct tools and materials to manufacture, assemble and complete functionality tests on an artefact. Learners will evaluate and report their findings on the manufacture, assembly and functionality tests of the artefact. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.

Conditions of award

To achieve the award of National 4 Skills for Work Engineering Skills, learners must achieve all the required units as outlined in the course outline. They will be assessed pass/fail within centres. Skills for Work Courses are not graded. October 2018, version 3.0

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Assessment

Assessment objectives

Assessment across the units in this course will primarily test practical skills but will also address the technical knowledge and understanding associated with those skills in engineering at National 4. In particular, assessment will focus on:

- practical vocational skills
- skills for employment in an engineering context

Unit assessment

In all of the units that focus on the development of specific engineering skills, assessment

follows a similar pattern involving a range of practical activities which will produce evidence for all the outcomes. The evidence will be confirmed by the use of an assessor checklist, which will cover:

- interpretation of a drawing or specification
- the appropriate use of tools, materials and equipment
- successful involvement in the completion of a task, product or assembly
- quality checking of their work by the learner
- attention to health and safety aspects of working in a workshop type of environment

The assessment of employability skills is integrated in all of the units and is based on assessor checklists and the completion of a learner review sheet on four different occasions throughout the course. This review allows the learner to record development of employability skills in the context of different skill areas.

Further details about unit assessment for this course can be found in the unit specifications and the ASP materials.

Exemplification of possible assessment approaches for these units will be provided in the ASP.

Quality assurance

All instruments of assessment used within this course should be internally verified, using the appropriate policy within the centre and the guidelines set by SQA.

External verification will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

Further information on internal and external verification can be found in *SQA's Guide to Assessment* (www.sqa.org.uk/GuideToAssessment).October 2018, version 3.0

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Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this course. The skills that learners will be expected to improve on and develop through the course are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the course where there are appropriate opportunities.

1

Literacy

1.1 Reading

1.2 Writing

1.3 Listening and talking

3

Health and Wellbeing

3.1 Personal learning

3.2 Emotional wellbeing

3.4 Planning for, and making, choices and changes

4

Employability, enterprise and citizenship

4.1 Employability
4.3 Working with others
4.4 Enterprise
5
Thinking Skills
5.1 Remembering
5.2 Understanding
5.3 Applying
5.4 Analysing and evaluating
5.5 Creating
Amplification of these skills is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work*. The level of these skills will be appropriate to the level of the course.October 2018, version 3.0
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Employability skills profile
Employability skills covered in this course are detailed in the table below. For the purposes of the table, the units are referred to as A, B, C and D as indicated.
Engineering Skills: Mechanical
= A
Engineering Skills: Electrical/Electronic
= B
Engineering Skills: Fabrication
= C
Engineering Skills: Manufacture and Assembly
= D
Employability skill/attitude
Evidence
♦ maintaining good time-keeping
A, B
♦ maintaining good attendance
B, C
♦ maintaining a tidy workplace
A, C
♦ following instructions
A, D
♦ seeking advice
A, D
♦ working co-operatively with others
A, D
♦ sourcing and use of tools in a correct and safe manner
B, C
♦ using tools solely for the purpose for which they are designed

B, C
- ♦ cleaning and storing tools correctly after use

A, B
- ♦ recognising common materials

A, C
- ♦ showing health and safety awareness

A, B, C, D
- ♦ wearing appropriate personal protective equipment

A, C
- ♦ preparing appropriately to carry out tasks

C, D
- ♦ following basic drawings and specifications

B, D
- ♦ checking own work

A, B, C, D
- ♦ identifying own strengths and weaknesses

A, B, C, D
- ♦ identifying learning points from practical experiences

A, B, C, D
- ♦ positive attitude to learning

A, B, C, D

Assessment evidence in all units:

Performance evidence, supported by learner review sheets and assessor observation checklists.October 2018, version 3.0

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Course support notes

Course support notes are not mandatory; they provide advice and guidance on approaches to delivering and assessing the Skills for Work course. They are intended for teachers and lecturers who are delivering the course and its units.

Guidance on approaches to delivery and assessment for this course

The course has been designed to ensure that learners learn through practical experiences. The main focus in each of the skills specific units is on practical work. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical engineering activities within the units.

Health and safety is integral to all practical tasks and should be emphasised at the start of and throughout each lesson.

Brief lessons on workshop protocol should also be included.

Teaching and learning approaches will include demonstrations of practical work by tutors. Short lessons on specific aspects of industrial practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the learners practise the skill emphasised by the demonstration.

Given the practical nature of teaching/learning and assessment, centres should ensure that teaching blocks are of sufficient time to allow a meaningful experience for learners.
Reflecting on practical experiences and learning from them is an approach that is embedded in the course. Throughout the learning experiences, the emphasis should be on helping learners to develop an awareness of the employability skills and attitudes needed for the engineering industry, for example, good time-keeping, co-operating with others, taking instructions, and a positive attitude to learning. Opportunities to develop these skills and attitudes arise naturally in the work of the course. Learners should be aware that these generic skills are just as important as the practical engineering skills they are developing.
For example, it is important for workshop activities to be carried out to effective schedules; learners will have opportunities to demonstrate good time-keeping in the context of these schedules. Learners will have to co-operate with others regarding shared workspace, tools and equipment. They will have to co-operate and communicate regarding the transfer of materials, tools and equipment safely around and across the workshop. Learners will be encouraged to develop a positive attitude to waste minimisation and environmental issues regarding the use of materials.
The work of the course will increase awareness that health and safety issues are important in the world of work generally and in engineering in particular.
In carrying out engineering activities, learners will learn that there are correct and incorrect ways to use tools and equipment. Tutors will have ample opportunity to demonstrate good practice and correct procedures to learners, who will learn the importance to self and others of following instructions. Such positive experiences will foster a positive attitude to learning.October 2018, version 3.0
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Teaching and learning approaches should impart enthusiasm and help to inform learners of realistic prospects in the engineering sector or in industry generally. They should become aware of steps to employment or further training. Through their experiences of the various practical skills in the course, they should become better equipped to make valid personal choices regarding careers and further study.

Sequencing/integration of units

The course has four mandatory units which offer a broad range of different engineering experiences. It is recommended that the unit *Engineering Skills: Mechanical* (National 4) is attempted and completed initially as some aspects of the content of this unit are incorporated
in all of the other course units. The *Engineering Skills: Manufacture and Assembly* (National 4) unit should only be attempted after successful completion of the other three units.
It is important that a well-planned induction to the course is delivered, emphasising its integrated nature and stressing the importance of generic employability skills throughout.
Employability skills should span the course, allowing learners ample opportunity to develop and review employability skills and attitudes over a range of engineering skills and over a reasonable period of time.

Guidance on approaches to delivery

Throughout the course, the need for correct preparation for practical activities should be stressed. However, such preparation should not take excessive time to complete. Teaching correct skills practice, effective use of tools and equipment and a positive view of health and safety should help to ensure that preparation for practical work is comprehensive.
Learners will require supervision during practical work — both on a skills level and for health and safety reasons. The learning environment should be designed to minimise risks and provide a safe context for carrying out tasks. For example, when undertaking the task of Metal Active Gas (MAG) welding learners should be made aware of the risk from fire, fumes and harmful rays to themselves and others.
It is recommended that each practical session be preceded by a 'tool box' talk on an aspect of health and safety relevant to the work in hand. It is recommended that learners be given regular but short practice sessions in the correct use of the materials to be used in each session as well as coaching in the correct use of associated tools and equipment.
Centres are encouraged to establish links with local industry. Local engineering companies, trades associations, Sector Skills Councils (SSCs), Institutes and Chambers of Commerce may be prepared to offer support, for example, in the form of visits from representatives of their organisations. Visitors from industry will be able to give learners a realistic view of jobs and conditions in the engineering industry.
It may be possible for centres to arrange visits to engineering works as part of the learners' learning experience. Visits to local industry are often particularly useful because work in progress will be at different stages and learners can see various different trades working at the same time. Industrial visits should be carefully arranged, organised and authorised. It would be preferable for those responsible for such visits to have prior knowledge of the industry in question.October 2018, version 3.0
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Guidance on approaches to assessment

Approaches to assessment that promote the efficient and effective gathering of evidence are to be encouraged.
The development and assessment of generic employability skills is a key feature of this course and is integrated with the skills specific units. Learners can readily gather evidence for assessment during their work in these practical skills units. Reviewing progress with engineering employability skills and attitudes will take place in the practical context of work in the different activities. Learners will complete a minimum of four review sheets in the different
trade activities. Assessment of interpreting drawings and specifications and materials should also take place during the work in skills specific practical units. An employability skills profile for the course is included and this gives a clear indication of where assessment evidence is gathered for generic employability skills.
Within the skills specific practical units, the learner will produce evidence as a natural part of the learning and teaching process. Learners will first learn and practise the correct techniques and methods for each of the skills they undertake. Assessment of the various practical tasks will take place at appropriate points throughout the course, allowing time for learners to make quality checks of their finished products against the prescribed tolerances,

before being submitted for assessment.
In the *Engineering Skills: Manufacture and Assembly* (National 4) unit learners can if appropriate work in teams of no more than three to manufacture and assemble an artefact. It is expected that the artefact produced by such a team will be of sufficient complexity and scope to allow all members of the team to make a contribution equal to the manufacture and assembly of an artefact by an individual learner. The artefact manufactured by a team can be, for example, a community-based project for the school, college or a youth group. Where this occurs, each learner must identify their contribution to the completion of the task and present evidence to satisfy the assessor that all outcomes and performance criteria have been met.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this course. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core Skills

Opportunities to develop aspects of Core Skills should be used where they arise naturally. For example, in order to carry out engineering activities in a workshop environment, learners will develop aspects of Numeracy when making engineering calculations and taking measurements. They will also have to communicate simple engineering terms with tutors and fellow learners regarding skills practices, materials and tools, health and safety and working together in the workplace. Aspects of Problem Solving will arise through their participation in practical work.October 2018, version 3.0
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Teaching and learning approaches should encourage learners to take responsibility for their own learning and development. In the practical units of the course, learners need to carry out quality checks on their own work. This provides a good opportunity to motivate learners to take pride in their work. The integration of employability skills, in particular self-evaluation skills, will allow learners to take responsibility for seeking feedback and identifying action points for improvement in their own performance. This should help to develop confidence in taking advice and in asking for direction and assistance where necessary.
This course gives automatic certification of the Core Skill component Critical Thinking at SCQF level 4. October 2018, version 3.0
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General information for learners

The National 4 Skills for Work Engineering Skills course focuses on four broad areas of engineering — mechanical, electrical/electronic, fabrication and manufacture.
You will learn the basic skills across these areas by the:

- Interpretation of a drawing or specification.
- Appropriate use of tools, materials and equipment.

- Successful involvement in the completion of a task, product or assembly.
- Quality checking of your own work.
- Attention to health and safety aspects of working in a workshop type of environment.

Integrated throughout the course is the development of generic employability skills valued by employers in an engineering sector. Your assessor will use checklists and you will complete a learner review sheet on four different occasions throughout the course.

The National 4 Skills for Work Engineering Skills course provides a basis for progression into further education or for moving directly into training in employment within an engineering sector. October 2018, version 3.0

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Administrative information

Published:

October 2018 (version 3.0)

History of changes to national course specification

Version	Description of change	Date
2.0	2013 — course re-coded as part of CfE development programme but no change to course and unit content.	August 2013
3.0	Course specification moved to a new template. No change to content. Units re-coded to align with corresponding course code.	October 2018

2

Note: You are advised to check SQA's website (www.sqa.org.uk) to ensure you are using the most up-to-date version of the course specification.

National 4 Skills for Work

Engineering Skills Course

Specification

(C243 74)

Valid from August 2013

This edition, October 2018, version 3.0

Please refer to the note of changes at the end of this course specification for details of

changes from previous version (where applicable).
October 2018, version 3.0
1
Course outline
Course title:
National 4 Skills for Work Engineering Skills
SCQF credit points:
(24 SCQF credit points)
Course code:
C243 74
Mandatory units
The course comprises the following mandatory units:
J16F 74
Engineering Skills: Mechanical
6 SCQF credit points
J16G 74
Engineering Skills: Electrical/Electronic
6 SCQF credit points
J145 74
Engineering Skills: Fabrication
6 SCQF credit points
J144 74
Engineering Skills: Manufacture and Assembly 6 SCQF credit points
Recommended entry
Entry to this course is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by the following or equivalent qualifications and/or experience:

- an interest in engineering
- an ability to work in numeracy and literacy at SCQF level 3
- some aptitude for graphical forms of communication

In terms of prior learning and experience, relevant experiences and outcomes may also provide an appropriate basis for doing this course.
Progression
This course or its components may provide progression to:

- Scottish Progression Award in Engineering (National 5)
- SVQs and Modern Apprenticeships in Engineering areas
- further study, employment and/or trainingOctober 2018, version 3.0

2
Core Skills
Achievement of this course gives automatic certification of the following Core Skills component:
Core Skill component

Critical Thinking at SCQF level 4

There are also opportunities to develop aspects of Core Skills which are highlighted in the support notes of this unit specification.

Links to National Occupational Standards

National Occupational Standards (NOS) are developed by the key employment sectors of the United Kingdom. These standards set the competences required for job roles within a particular employment sector.

The National 4 Skills for Work Engineering Skills course has been designed to link broadly to NOS, but the standards required of first-year apprentices in the engineering industry are significantly more onerous than those in this course.

Compared to NOS, this course requires either reduced scale and complexity, or more achievable tolerances, and therefore provides a useful preparation for employment or further training in the engineering industry. The general tolerance required for the practical activities in this course should be ±3mm. The specific tolerances required for practical unit assessments are specified in the assessment support packs (ASPs).

Further details are provided in the 'Rationale' section.

Equality and inclusion

This Course Arrangements Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.October 2018, version 3.0

3

Common rationale for Skills for Work Courses

Skills for Work Courses are designed to help learners to develop:

- skills and knowledge in a broad vocational area
- skills for learning, skills for life and skills for work
- Core Skills
- an understanding of the workplace
- positive attitudes to learning
- skills and attitudes for employability

A key feature of these courses is the emphasis on *experiential learning*. This means learning through practical experience and learning by reflecting on experience.

Learning through practical experience

Teaching/learning programmes should include some or all of the following:

- learning in real or simulated workplace settings
- learning through role play activities in vocational contexts
- carrying out case study work
- planning and carrying out practical tasks and assignments

Learning through reflecting at all stages of the experience

Teaching/learning programmes should include some or all of the following:

- preparing and planning for the experience

- taking stock throughout the experience, reviewing and adapting as necessary
- reflecting after the activity has been completed, evaluating and identifying learning points

The Skills for Work Courses are also designed to provide learners with opportunities for developing *Core Skills*, and *Skills for Learning, Skills for Life and Skills for Work* with a focus on enhancing skills and attitudes for *employability*.October 2018, version 3.0
4

Core Skills

The five Core Skills are:

- Communication
- Numeracy
- Information and Communication Technology (ICT)
- Problem Solving
- Working with Others

Employability

The skills and attitudes for employability, including self-employment, are outlined below:

- generic skills/attitudes valued by employers
- understanding of the workplace and the employee's responsibilities, for example, time keeping, appearance, customer care, etc
- self-evaluation skills
- positive attitude to learning
- flexible approaches to solving problems
- adaptability and positive attitude to change
- confidence to set goals, reflect and learn from experience
- specific vocational skills/knowledge

Course specifications highlight the links to NOS in the vocational area and identify progression opportunities.

Opportunities for developing these skills and attitudes are highlighted in each of the course and unit specifications. These opportunities include giving young people direct access to workplace experiences or, through partnership arrangements, providing different learning environments and experiences which simulate aspects of the workplace. These experiences might include visits, visiting speakers, role play and other practical activities.

A Curriculum for Excellence (Scottish Executive 2004) identifies aspirations for every young person. These are that they should become:

- successful learners
- confident individuals
- responsible citizens
- effective contributors

The learning environments, the focus on experiential learning and the opportunities to develop employability, Skills for Learning, Skills for Life, Skills for Work and Core Skills in these courses contribute to meeting these aspirations.October 2018, version 3.0
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Course rationale for National 4 Skills for Work Engineering Skills

All new and revised National Courses reflect Curriculum for Excellence values, purposes and principles. They offer flexibility, provide more time for learning, more focus on skills and applying learning, and scope for personalisation and choice.

In this course, and its component units, there will be an emphasis on skills development and the application of those skills. Assessment approaches will be proportionate, fit for purpose and will promote best practice, enabling learners to achieve the highest standards they can.

This Skills for Work course is also designed to provide learners with opportunities for developing Core Skills and Skills for Learning, Skills for Life and Skills for Work, with a strong focus on enhancing skills and attitudes for employability.

The National 4 Skills for Work Engineering Skills course has been designed to provide a basis for progression into further education or for moving directly into training in employment

within an engineering sector. The overall purpose of the course is to ensure that learners start to develop the generic and practical skills, knowledge and understanding and employability skills needed within an engineering sector.

The engineering sector includes the following:

Mechanical
Manufacture
Maintenance
Fabrication
Welding
Electrical
Electronic
Foundry
Automotive
Servicing
Transport
Aeronautical
Communications
Space
Energy generation
Conservation
Marine
Water
Salination
Oil/Gas
Petroleum

This course focuses on the four broad areas of mechanical, electrical/electronic, fabrication and manufacture. This will allow the learners to gain basic transferable skills which can be applied to any of the above engineering areas.

Purposes and aims of the course

The general aims of this course are to:

- Widen participation in vocationally-related learning for school learners from S3 upwards.
- Allow learners to experience vocationally-related learning.
- Provide learners with a broad introduction to the engineering vocational sector.
- Encourage learners to foster a good work ethic, including time-keeping, a positive attitude
and other relevant employability skills.
- Provide opportunities to develop a range of Core Skills in a vocational context.
- Encourage learners to take charge of their own learning and development.
- Provide a range of teaching, learning and assessment styles to motivate learners to achieve their full potential.
- Facilitate progression to further education and/or training.
- Encourage learners to plan their work and review their progress.
- Encourage learners to develop a positive attitude to waste minimisation and environmental issues.October 2018, version 3.0

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In particular, the aims of the National 4 Skills for Work Engineering Skills course are to:

- Encourage learners to consider a career in the engineering industry.
- Develop an awareness of the opportunities there may be within engineering in terms of the types and range of career options.
- Enable learners to develop and apply practical, technical and communication skills as a foundation for future learning and progression.
- Develop the learners' awareness of their individual strengths and weaknesses in relation to the requirements of engineering, and to reflect on how this affects their employability potential.
- Give learners the technical knowledge, skills and understanding associated with a range of skills in engineering at this level.
- Encourage learners to apply their knowledge and understanding of engineering by using skills of evaluation and problem solving in a vocational context.
- Develop an awareness that health and safety issues are integral to the world of work generally and engineering in particular.
- Prepare learners for further learning opportunities, study and training for employment in engineering and related occupations.

Information about typical learners who might do the course

The primary target group for this course is school learners in S3 and above. This course is designed at a level and scope such that it can be delivered in schools, if the school has suitable facilities and teaching expertise.

Due to the specialist expertise and facilities available in further education colleges and with training providers, it is anticipated that the course will rely on, and build on, existing partnerships between schools, further education colleges, training providers and employers, A partnership approach will enable the course to be delivered in a variety of appropriate learning environments enhancing the learning experience.

The course is also suitable for adult learners who are seeking to enhance their employability and develop introductory vocational skills in an engineering sector.October 2018, version 3.0 7

Course structure and conditions of award

Summary of course content

This course comprises four 40-hour units. The content of the course focuses on the development of basic hand skills across the disciplines of mechanical, electrical/electronic, fabrication and manufacture and assembly. Central to the content are the generic employability skills valued by employers in an engineering sector. These skills are developed in each of the four units and are assessed at least twice during the course. These add value to the development of the specific vocational skills.

All the engineering skills units, while focusing on specific skill areas, also address generic skills related to:

- engineering communications
- engineering materials
- measurement and marking
- working to tolerances
- Core Skills

The engineering skills units also include employability skills outlined below:

- time-keeping and attendance
- positive attitudes to learning
- responding positively to advice and feedback
- following instructions
- working co-operatively with others
- health and safety awareness
- necessary preparation planning
- checking own work
- problem solving

Summary of unit content

Units are statements of standards for assessment and not programmes of learning and teaching. They can be delivered in a variety of ways; however Skills for Work units are designed to provide an experiential learning process.

Engineering Skills: Mechanical (National 4)

This unit is designed to be the first attempted on the course. Learners are required to select the correct tools and materials required to safely manufacture an artefact. During the manufacture, learners will read simple engineering drawings, measure and mark, select appropriate materials and work to specified tolerances. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.

Engineering Skills: Electrical/Electronic (National 4)

In this unit learners will select the correct tools and components required to construct a basic functional extra low voltage electrical/electronic circuit from a given diagram and

specification. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.October 2018, version 3.0

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Engineering Skills: Fabrication (National 4)

In this unit learners will select the correct tools, materials and equipment required to manufacture an artefact using cutting, hot and cold forming and mechanical and thermal joining techniques. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.

Engineering Skills: Manufacture and Assembly (National 4)

This unit is designed to be attempted only after successful completion of the preceding skills units. Learners will select and safely use the correct tools and materials to manufacture, assemble and complete functionality tests on an artefact. Learners will evaluate and report their findings on the manufacture, assembly and functionality tests of the artefact. Embedded into the practical activities of this unit are the employability skills that employers value. Although it is envisaged that all employability skills will be developed in this unit, not all will be assessed.

Conditions of award

To achieve the award of National 4 Skills for Work Engineering Skills, learners must achieve all the required units as outlined in the course outline. They will be assessed pass/fail within centres. Skills for Work Courses are not graded. October 2018, version 3.0

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Assessment

Assessment objectives

Assessment across the units in this course will primarily test practical skills but will also address the technical knowledge and understanding associated with those skills in engineering at National 4. In particular, assessment will focus on:

- practical vocational skills
- skills for employment in an engineering context

Unit assessment

In all of the units that focus on the development of specific engineering skills, assessment follows a similar pattern involving a range of practical activities which will produce evidence for all the outcomes. The evidence will be confirmed by the use of an assessor checklist, which will cover:

- interpretation of a drawing or specification
- the appropriate use of tools, materials and equipment
- successful involvement in the completion of a task, product or assembly
- quality checking of their work by the learner
- attention to health and safety aspects of working in a workshop type of environment

The assessment of employability skills is integrated in all of the units and is based on assessor checklists and the completion of a learner review sheet on four different occasions

throughout the course. This review allows the learner to record development of employability skills in the context of different skill areas.
Further details about unit assessment for this course can be found in the unit specifications and the ASP materials.
Exemplification of possible assessment approaches for these units will be provided in the ASP.

Quality assurance

All instruments of assessment used within this course should be internally verified, using the appropriate policy within the centre and the guidelines set by SQA.
External verification will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.
Further information on internal and external verification can be found in *SQA's Guide to Assessment* (www.sqa.org.uk/GuideToAssessment).October 2018, version 3.0
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Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this course. The skills that learners will be expected to improve on and develop through the course are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the course where there are appropriate opportunities.

1
Literacy
1.1 Reading
1.2 Writing
1.3 Listening and talking

3
Health and Wellbeing
3.1 Personal learning
3.2 Emotional wellbeing
3.4 Planning for, and making, choices and changes

4
Employability, enterprise and citizenship
4.1 Employability
4.3 Working with others
4.4 Enterprise

5
Thinking Skills
5.1 Remembering
5.2 Understanding
5.3 Applying
5.4 Analysing and evaluating
5.5 Creating

Amplification of these skills is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work*. The level of these skills will be appropriate to the level of the course.October 2018, version 3.0
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Employability skills profile

Employability skills covered in this course are detailed in the table below. For the purposes of the table, the units are referred to as A, B, C and D as indicated.

Engineering Skills: Mechanical
= A
Engineering Skills: Electrical/Electronic
= B
Engineering Skills: Fabrication
= C
Engineering Skills: Manufacture and Assembly
= D
Employability skill/attitude
Evidence

♦ maintaining good time-keeping
A, B
♦ maintaining good attendance
B, C
♦ maintaining a tidy workplace
A, C
♦ following instructions
A, D
♦ seeking advice
A, D
♦ working co-operatively with others
A, D
♦ sourcing and use of tools in a correct and safe manner
B, C
♦ using tools solely for the purpose for which they are designed
B, C
♦ cleaning and storing tools correctly after use
A, B
♦ recognising common materials
A, C
♦ showing health and safety awareness
A, B, C, D
♦ wearing appropriate personal protective equipment
A, C
♦ preparing appropriately to carry out tasks

C, D

♦ following basic drawings and specifications

B, D

♦ checking own work

A, B, C, D

♦ identifying own strengths and weaknesses

A, B, C, D

♦ identifying learning points from practical experiences

A, B, C, D

♦ positive attitude to learning

A, B, C, D

Assessment evidence in all units:

Performance evidence, supported by learner review sheets and assessor observation checklists.October 2018, version 3.0

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Course support notes

Course support notes are not mandatory; they provide advice and guidance on approaches to delivering and assessing the Skills for Work course. They are intended for teachers and lecturers who are delivering the course and its units.

Guidance on approaches to delivery and assessment for this course

The course has been designed to ensure that learners learn through practical experiences. The main focus in each of the skills specific units is on practical work. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical engineering activities within the units.

Health and safety is integral to all practical tasks and should be emphasised at the start of and throughout each lesson.

Brief lessons on workshop protocol should also be included.

Teaching and learning approaches will include demonstrations of practical work by tutors. Short lessons on specific aspects of industrial practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the learners practise the skill emphasised by the demonstration. Given the practical nature of teaching/learning and assessment, centres should ensure that teaching blocks are of sufficient time to allow a meaningful experience for learners.

Reflecting on practical experiences and learning from them is an approach that is embedded in the course. Throughout the learning experiences, the emphasis should be on helping learners to develop an awareness of the employability skills and attitudes needed for the engineering industry, for example, good time-keeping, co-operating with others, taking instructions, and a positive attitude to learning. Opportunities to develop these skills and attitudes arise naturally in the work of the course. Learners should be aware that these generic skills are just as important as the practical engineering skills they are developing.

For example, it is important for workshop activities to be carried out to effective schedules; learners will have opportunities to demonstrate good time-keeping in the context of these

schedules. Learners will have to co-operate with others regarding shared workspace, tools and equipment. They will have to co-operate and communicate regarding the transfer of materials, tools and equipment safely around and across the workshop. Learners will be encouraged to develop a positive attitude to waste minimisation and environmental issues regarding the use of materials.

The work of the course will increase awareness that health and safety issues are important in the world of work generally and in engineering in particular.

In carrying out engineering activities, learners will learn that there are correct and incorrect ways to use tools and equipment. Tutors will have ample opportunity to demonstrate good practice and correct procedures to learners, who will learn the importance to self and others of following instructions. Such positive experiences will foster a positive attitude to learning.October 2018, version 3.0

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Teaching and learning approaches should impart enthusiasm and help to inform learners of realistic prospects in the engineering sector or in industry generally. They should become aware of steps to employment or further training. Through their experiences of the various practical skills in the course, they should become better equipped to make valid personal choices regarding careers and further study.

Sequencing/integration of units

The course has four mandatory units which offer a broad range of different engineering experiences. It is recommended that the unit *Engineering Skills: Mechanical* (National 4) is attempted and completed initially as some aspects of the content of this unit are incorporated

in all of the other course units. The *Engineering Skills: Manufacture and Assembly* (National 4) unit should only be attempted after successful completion of the other three units.

It is important that a well-planned induction to the course is delivered, emphasising its integrated nature and stressing the importance of generic employability skills throughout. Employability skills should span the course, allowing learners ample opportunity to develop and review employability skills and attitudes over a range of engineering skills and over a reasonable period of time.

Guidance on approaches to delivery

Throughout the course, the need for correct preparation for practical activities should be stressed. However, such preparation should not take excessive time to complete. Teaching correct skills practice, effective use of tools and equipment and a positive view of health and safety should help to ensure that preparation for practical work is comprehensive.

Learners will require supervision during practical work — both on a skills level and for health and safety reasons. The learning environment should be designed to minimise risks and provide a safe context for carrying out tasks. For example, when undertaking the task of Metal Active Gas (MAG) welding learners should be made aware of the risk from fire, fumes and harmful rays to themselves and others.

It is recommended that each practical session be preceded by a ‘tool box’ talk on an aspect of health and safety relevant to the work in hand. It is recommended that learners be given

regular but short practice sessions in the correct use of the materials to be used in each session as well as coaching in the correct use of associated tools and equipment.
Centres are encouraged to establish links with local industry. Local engineering companies, trades associations, Sector Skills Councils (SSCs), Institutes and Chambers of Commerce may be prepared to offer support, for example, in the form of visits from representatives of their organisations. Visitors from industry will be able to give learners a realistic view of jobs and conditions in the engineering industry.
It may be possible for centres to arrange visits to engineering works as part of the learners' learning experience. Visits to local industry are often particularly useful because work in progress will be at different stages and learners can see various different trades working at the same time. Industrial visits should be carefully arranged, organised and authorised. It would be preferable for those responsible for such visits to have prior knowledge of the industry in question.October 2018, version 3.0
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Guidance on approaches to assessment

Approaches to assessment that promote the efficient and effective gathering of evidence are to be encouraged.
The development and assessment of generic employability skills is a key feature of this course and is integrated with the skills specific units. Learners can readily gather evidence for assessment during their work in these practical skills units. Reviewing progress with engineering employability skills and attitudes will take place in the practical context of work in the different activities. Learners will complete a minimum of four review sheets in the different
trade activities. Assessment of interpreting drawings and specifications and materials should also take place during the work in skills specific practical units. An employability skills profile for the course is included and this gives a clear indication of where assessment evidence is gathered for generic employability skills.
Within the skills specific practical units, the learner will produce evidence as a natural part of the learning and teaching process. Learners will first learn and practise the correct techniques and methods for each of the skills they undertake. Assessment of the various practical tasks will take place at appropriate points throughout the course, allowing time for learners to make quality checks of their finished products against the prescribed tolerances, before being submitted for assessment.
In the *Engineering Skills: Manufacture and Assembly* (National 4) unit learners can if appropriate work in teams of no more than three to manufacture and assemble an artefact. It is expected that the artefact produced by such a team will be of sufficient complexity and scope to allow all members of the team to make a contribution equal to the manufacture and assembly of an artefact by an individual learner. The artefact manufactured by a team can be, for example, a community-based project for the school, college or a youth group. Where this occurs, each learner must identify their contribution to the completion of the task and present evidence to satisfy the assessor that all outcomes and performance criteria have been met.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this course. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core Skills

Opportunities to develop aspects of Core Skills should be used where they arise naturally. For example, in order to carry out engineering activities in a workshop environment, learners will develop aspects of Numeracy when making engineering calculations and taking measurements. They will also have to communicate simple engineering terms with tutors and fellow learners regarding skills practices, materials and tools, health and safety and working together in the workplace. Aspects of Problem Solving will arise through their participation in practical work.October 2018, version 3.0

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Teaching and learning approaches should encourage learners to take responsibility for their own learning and development. In the practical units of the course, learners need to carry out quality checks on their own work. This provides a good opportunity to motivate learners to take pride in their work. The integration of employability skills, in particular self-evaluation skills, will allow learners to take responsibility for seeking feedback and identifying action points for improvement in their own performance. This should help to develop confidence in taking advice and in asking for direction and assistance where necessary.

This course gives automatic certification of the Core Skill component Critical Thinking at SCQF level 4. October 2018, version 3.0

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General information for learners

The National 4 Skills for Work Engineering Skills course focuses on four broad areas of engineering — mechanical, electrical/electronic, fabrication and manufacture.

You will learn the basic skills across these areas by the:

- ♦ Interpretation of a drawing or specification.
- ♦ Appropriate use of tools, materials and equipment.
- ♦ Successful involvement in the completion of a task, product or assembly.
- ♦ Quality checking of your own work.
- ♦ Attention to health and safety aspects of working in a workshop type of environment.

Integrated throughout the course is the development of generic employability skills valued by employers in an engineering sector. Your assessor will use checklists and you will complete a learner review sheet on four different occasions throughout the course.

The National 4 Skills for Work Engineering Skills course provides a basis for progression into further education or for moving directly into training in employment within an engineering sector. October 2018, version 3.0

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Administrative information

Published:

October 2018 (version 3.0)

History of changes to national course specification

Version Description of change

Date

2.0

2013 — course re-coded as part of CfE development programme
but no change to course and unit content.

August 2013

3.0

Course specification moved to a new template. No change to
content. Units re-coded to align with corresponding course 2
code.

October 2018

Note: You are advised to check SQA's website (www.sqa.org.uk) to ensure you are using the most up-to-date version of the course specification.

Introduction to Digital Question Papers

for Centres

Publication date: November 2021

Publication code: FA4378b

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The Optima Building, 58 Robertson Street, Glasgow G2 8DQ

Lowden, 24 Wester Shawfair, Dalkeith, EH22 1FD

www.sqa.org.uk

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please
write to Editor, Editorial Team, at the Glasgow address or email: editor@sqa.org.uk.**Contents**
What is a digital question paper?

A digital question paper is a digitised version of the question paper that can be completed electronically using a PC, laptop, or tablet. Digital question papers are produced in Portable Document Format (PDF), an open standard file format compatible with many software applications, operating systems, and hardware platforms.

Like physical question papers, digital question papers are either in the combined question and answer format or the question only format. The combined question and answer format digital question papers have answer spaces enabled within the file for completion. The question only format digital question papers have an associated digital answer booklet. Digital answer booklets are produced in PDF format and Microsoft Word format. Both formats have answer spaces enabled within the file for completion.

Combined question and answer format digital question paper

1**Digital answer booklet in PDF format**

Who can use a digital question paper?

Digital question papers can only be used by disabled candidates and those identified as having additional support needs who have an approved assessment arrangement. Digital question papers may be suitable for candidates who have difficulty reading the physical question paper or who have difficulty writing their responses on the physical question paper or answer booklet.

Candidates use a PC, laptop, or tablet to access digital question papers. This enables them to adjust the colour of the paper and the text, and, to read and respond to questions, in conjunction
with a range of other assistive technologies.

Any candidates using information and communication technology (ICT) to complete their question papers can use a digital answer booklet. Digital answer booklets are available on our digital question papers website.

Further information on assessment arrangements can be found on our assessment arrangements website.

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What hardware and software do my centre need to use digital question papers?

Hardware

To use digital question papers your centre will require a PC or laptop or tablet. We recommend that PCs and laptops are running Windows. We recommend that tablets are iPads. Digital question papers must be printed at the end of the exam, so your centre will also require a printer.

Chromebooks

We asked CALL Scotland to investigate the use of Chromebooks for assessment arrangements, including digital question papers. CALL Scotland's report, published in 2020, is available on the Chromebook section of the CALL Scotland website. The report highlights that currently, there is no satisfactory solution for accessing and using our digital question papers on a Chromebook. We are actively investigating this issue, but until we have a satisfactory solution, we do not advocate the use of Chromebooks to access and use our digital question papers for the 2022 exam diet.

Software

To use digital question papers your centre will require an application that can read PDFs. The most widely used free application is Adobe Acrobat Reader, but many other free and paid-for applications are available.

To use the Microsoft Word digital answer booklets your centre will require Microsoft Word or another application that can read Microsoft Word documents.

Many assistive technology applications are available. Depending on the needs of your candidates, you may need to investigate which assistive technology applications you require.

More detailed advice and guidance on hardware, software, and assistive technology can be found on the setting up and using digital exams section of the CALL Scotland website.4

How does my centre request digital question papers?

Digital question papers must be requested using the Assessment Arrangements Request (AAR) system. We issue access details and instructions for using the AAR system to your centre's SQA Co-ordinator each year.

Requests for digital question papers must be submitted by the date specified in our *Delivering National Qualifications Key Dates* document. This enables us to produce, collate, and distribute all digital question papers to all centres in time for the exam diet.

How does SQA create digital question papers?

We can only begin creating a digital question paper once the physical question paper has been through all its quality assurance stages and has been signed off as approved for the exam.

Our skilled staff use specialist software to convert the physical question paper file into a

digital
question paper, adding bookmarks for sections, parts, and questions. For combined question and answer format digital question papers, they also create answer boxes and spaces where answer lines or spaces appear in the physical question paper.

Our staff then check the digital question paper against the physical question paper and check that bookmarks are correct, and that answer boxes and spaces have been added correctly.

We
create two versions of question-and-answer format digital question papers. One has spell checking enabled and one has spell checking disabled.

A similar process is used to create digital answer booklets. We create two versions of PDF digital answer booklets. One has spell checking enabled and one has spell checking disabled. We also create a Word digital answer booklet.

We duplicate digital question paper files and associated digital answer booklet files on CD. We gather all the requests for digital question papers from all centres and collate, package, and distribute the digital question paper CDs to centres in advance of the exam diet.5

How can candidates practise using digital question papers?

Your candidates must

- Practise using digital question papers, including under exam conditions, before they sit an exam during the exam diet using a digital question paper.
- Be familiar with the PC, laptop or tablet they are using to access a digital question paper.
- Be familiar with the software they are using to access a digital question paper, and any functionality within the software they are using.
- Be familiar with any assistive technologies they are using with digital question papers.

We make all our digital question papers available on our website after the exam diet. As with physical past question papers, these are available for five years. Our digital answer booklets are
available on our website. As these contain no confidential question content, they are available permanently, although they may, on occasion, be updated. You can access past digital question
papers and digital answer booklets on our digital question papers website. We recommend that
your candidates practise using past digital question papers and digital answer booklets.

You may wish to create your own digital question papers. Advice and guidance on this can be found on the making digital prelim papers section of the CALL Scotland website.

Where can I get further information on digital question papers?

SQA

An Introduction to Digital Question Papers for Candidates and a Digital Question Papers Exam Guide for Centres are available. Our digital question papers website contains these guides, past
digital question papers, digital answer booklets and other resources.

Our Assessment Arrangements team manages the assessment arrangements request system

and provides advice and guidance on assessment arrangements, including digital question papers.
Phone: 0345 213 6890
Email: aarequests@sqa.org.uk
Web: http://www.sqa.org.uk/assessmentarrangements
Our NQ Assessment team produces and distributes digital question papers.
Phone: 0345 213 6807
E-mail: question.papers@sqa.org.uk

CALL Scotland

We work in partnership with CALL Scotland (Communication, Access, Literacy and Learning) on
developing and supporting digital question papers. CALL have a website dedicated to digital question papers, providing a wealth of advice and guidance to support you and your candidates
in using digital question papers.

CALL Scotland
University of Edinburgh
Moray House
Paterson's Land
Holyrood Road
Edinburgh
EH8 8AQ
Phone: 0131 651 6235
Email: webmaster@callscotland.org.uk
Web: https://www.adapteddigitalexams.org.uk/home/
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Assessment Arrangements
Learner Agreement Form

Details

Learner's name:

Learner's SCN:

Subject(s):

Requested assessment arrangements:

As part of the process of requesting your assessment arrangements, we need to share the following information about you with SQA:

your name, SCN, date of birth, and the name of this centre (usually a school or college)

an indication of your disability or identified difficulty

details of the assessment arrangement(s) you need

SQA will only use this information to process your request for assessment arrangements. This information is not shared with anyone outside of SQA, and is only kept for as long as it is needed to support your request.

Learner's agreement

I confirm that I have been involved in discussions about and agree to the assessment arrangements being requested.

Print name:

Signature:

Date:

Parent or carer confirmation (if applicable)

I confirm that I have been involved in discussions about the assessment arrangements requested for my child.

Print name:

Signature:

Date:

There's more information about how SQA uses your information in their Privacy Statement

https://www.sqa.org.uk/sqa/45397.html

Unit assessment: class checklist									
xxxx xx name of Unit									
Class				Group					
	Candidate Surname	Candidate Forename	Candidate ID	Outcomes				Overall Achievement*	
				1	2	3	4		
1								P	F
2								P	F
3								P	F
4								P	F
5								P	F
6								P	F
7								P	F
8								P	F
9								P	F
10								P	F
11								P	F
12								P	F
13								P	F
14								P	F
15								P	F
16								P	F
17								P	F
18								P	F
19								P	F
20								P	F
21								P	F
22								P	F
23								P	F
24								P	F

25								P	F

* Mark as appropriate

Assessment Exemplar for Higher National Units
Guidance note: Introduction and How to Generate Evidence

1 st edition: September 2008
2 nd edition: January 2010
Publication code: xxxx
Published by the Scottish Qualifications Authority, The Optima Building, 58 Robertson Street, Glasgow, G2 8DQ, and Ironmills Road, Dalkeith, Midlothian, EH22 1LE
Guidance note: Introduction and How to Generate Evidence

Scottish Qualifications Authority Assessment Exemplars for Higher National Units

1

1 Introduction

This pack must be used in conjunction with a copy of the Unit specification which details the standard of performance expected of the candidate. A copy of the Unit specification can be obtained from SQA.

This pack supplements the assessment guidelines and support notes of the Unit specification. It aims to provide an example of assessment that is valid, reliable and practicable. The assessment task(s) detailed in this pack correspond to the assessment guidelines outlined in the Unit specification.

Whilst the example provided is intended for guidance, it may also be used as an assessment instrument, as long as the centre ensures the integrity and confidentiality of the assessment in the first and subsequent years of use and between centres. It may be used in a variety of ways including, for example:

as an assessment instrument, in whole or in part
to exemplify the standard of performance expected of candidates achieving the Unit, ie as a benchmark
to help you develop your own assessment for the Unit
to help you develop valid and practicable assessments for other Units within the subject area of the Group Award to which it contributes
to give you new ideas
as a staff development tool

It is important that you make sure that the assessment exemplar is used in a context appropriate to the delivery of the Unit and to the Group Award of which it forms a part. Although the content of this exemplar has been prior verified as a suitable instrument of assessment, you should note that using this assessment exemplar does not automatically guarantee successful external verification. It is still your responsibility to make sure that all the appropriate

internal quality assurance procedures are satisfactorily completed. For example, a valid, effective and approved internal verification system must be in use at your centre.

Recommended reading

Before using this material you might find it useful to look at some of our other publications, in particular:

Guide to Assessment

Introduction to Assessment Arrangements for Schools and Colleges

SQA's Quality Framework: a guide for centres

Details of these and other SQA publications are available on our website. Most publications can be downloaded free of charge from our website at: www.sqa.org.uk on the 'Publications, Sales and Downloads' section. If you require a publication to be sent to you, please telephone our Business Development and Customer Support Team on 0303 333 0330 quoting the product code and, where a charge is applicable, have a purchase order number or credit card details available.

Details of all HN assessment exemplars published after April 2004 are listed on our website on the HN subject-specific pages. Your centre's SQA or HN Co-ordinator will have access to these HN assessment exemplars on SQA's secure website. Please approach them for copies. However, if you require a paper copy you can obtain one from SQA's Business Development and Customer Support Team, Scottish Qualifications Authority, The Optima Building, 58 Robertson Street, Glasgow, G2 8DQ (telephone: 0303 333 0330 or fax: 0845 213 5000).

2

How to generate evidence

Introduction

The Scottish Qualifications Authority's system of assessment measures the evidence of a candidate's attainment of knowledge, understanding and skills against defined criteria. The assessment process must allow for evidence of each candidate's performance to be generated and collected. This evidence must then be judged against the standards set out in the Unit specification. To achieve the Unit the candidate must successfully meet the standards and there must be evidence to prove this.

The Unit specification defines the criteria you need to use to judge whether or not the candidate has met the standards. All Units have the following:

Outcomes

These tell you what the candidate actually has to do.

Knowledge and/or skills

This section details the essential knowledge and skills which the candidate must attain in order to achieve each Outcome, combination of Outcomes or for the Unit as a whole.

Evidence Requirements

Evidence Requirements can be written for each Outcome, for a combination of Outcomes, or for the Unit as a whole. There is no standard format for writing Evidence Requirements. Provided that they state clearly and unambiguously the type, standard and amount of evidence which candidates have to produce in order to be judged competent, the Evidence Requirements can be written in the format which will be most easily understood by users of the Unit.

Note: The national standard of achievement expected, which was previously specified as Performance Criteria, is now stated in the Evidence Requirements.

Where it is not possible to cover all the items listed under knowledge and/or skills through holistic assessment, sampling can be used as a method of gaining additional evidence. Sampling may also sometimes be an appropriate method of assessing very knowledge-based Units. This type of assessment must always be carried out in supervised conditions.

Where sampling is used, the Evidence Requirements must clearly state:

The standard of evidence required for each knowledge and/or skills item so that satisfactory performance can be judged whichever items are sampled on any one occasion.

The proportion of knowledge and/or skills which can be sampled.*Guidance note: Introduction and How to Generate Evidence*

Scottish Qualifications Authority Assessment Exemplars for Higher National Units

4

Whether any item(s) must be included in each assessment, ie if it is crucial to the achievement of the Outcome(s) or to an embedded Core Skill.

The fact that a different sample should be chosen on each assessment occasion to prevent candidates being able to foresee what they will be asked.

The conditions of assessment.

Assessment guidelines

This section should give guidance on how best to conduct the assessment to generate the evidence required, eg recommending the use of a particular assessment instrument. It should include guidance on how to integrate the assessment of the whole Outcome or, if appropriate, how to link assessment holistically with other Outcomes in the Unit. Like Evidence Requirements, assessment guidelines can be written for each Outcome, a combination of Outcomes, or for the Unit as a whole.

It is important to realise that it is up to the assessor to judge when and if the candidate has satisfactorily met the standards. This decision should be based on the quality and correct quantity of evidence collected, set against the

standards in the Unit.
The assessment instrument in this pack should not create any unnecessary barriers to achievement for open/distance learning delivery and the additional support needs of individual candidates should be taken into account. You may need to adapt it so that you can assess candidates with additional support needs or candidates who are undertaking the Unit on an open/distance learning basis. However, whilst taking into account the needs of the candidate concerned, the methods of assessment you choose must still be valid, reliable and practicable. If you have any questions or problems, or if you are in any doubt as to whether or not the alternative assessment you have chosen is still valid, please telephone the Business Development and Customer Support Team at the Scottish Qualifications Authority on: 0303 333 0330.

Core Skills

The Unit specification will detail the Core Skills covered within the Unit. Where Core Skills have been embedded in a Unit specification and an assessor wishes to use an alternative method of assessment, she/he must ensure that the assessment generates the Evidence Requirements specified in the Unit specification. It is recommended that the centre seek prior verification for t

Invigilator Report Form

National Qualifications 2025

All fields are mandatory and must be completed according to section 9 of the *Handbook for Invigilators*.

You must ensure that details reported are factual and do not express any personal opinion.

Centre name

Centre code

Full name of candidate involved

(Use Appx 1 where you have multiple candidates)

SCN of candidate
involved

Click on the grey box to populate an (x) next to the relevant field(s).

Prohibited item (**please state**)

____

☐ Please select Yes or No for the question below Yes

☐

Other possible malpractice

☐

Was the reminder given to the candidate(s) to undertake a final check to ensure they were not in possession of any prohibited items before the start of the exam?

No

☐

Date of exam Start time
Subject name
Level
Paper
Subject
code

Issue with the content of the exam material

☐

Disruption

☐

Centre/Invigilator Oversight

☐

ICT/Technical Issue

☐

Invigilator Misconduct

☐

All other incidents or interruptions

☐

Start time of incident or interruption:
End time of incident or interruption:What actions were taken?

Was this an AA candidate?

Yes

☐

No

☐

Were the correct Assessment Arrangements provided

Yes

☐

No

☐

N/A

☐

Was the candidate provided with the full exam time entitlement?

Yes

☐

No

☐

Full details of incident or interruption:*I confirm that the above information is factually accurate and that a copy of the report has*

been passed to the head of centre or their delegate.
Invigilator signature
Chief Invigilator signature
Date submitted
to SQA
Reports must be submitted by email **within two days** of the exam to
invigilator.enquiries@sqa.org.uk
A typed name is acceptable in place of a written signature.
Reports must not be enclosed in the script return envelopes or poly-envelope.
Where reports refer to any physical evidence - faulty QPs / faulty CDs / contaminated scripts - then
please use the return envelope marked Faulty Question Papers/CDs/Contaminated Scripts and return with the completed report to SQA.
For SQA use only
Date Received
Actioned By
Date Added to Database
Additional comments: Appendix 1 - Additional Candidates
Full name of candidate
SCN of candidate involved
he

Attendance Register Sup
plement
(Visiting Examining Additional Candidates)

This form is to be completed and given to the Visiting Assessor for those candidates whose names are not included on the appropriate pre-printed Ex6 Attendance Register and have been assessed for a practical component. An Attendance Register Supplement is to be completed for each course/level, up to a maxim um of ten candidates per form.

Centre making submission:

Centre No_Centre Name _ Presenting Centre if different from above:

Centre No_Centre Name _

Course Name_

eg Drama Higher

Course Code (*eg X821*)	National Course Level	National 5	Higher	Advanced Higher
	Circle as appropriate	75	76	77

	Candidate Name	Date of Birth	Scottish Candidate Number	Ma
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

1 Please ensure that this form is enclosed with the other candidates already on the Ex6 Attendance Register Form.

2 Ensure the SQA Co-Ordinator has submitted the new entry or change of level to the SQA.

Signature_Designation_Date _

For SQA use only

Entry checked		*Processed*		*Verified*	
Date		*Date*		*Date*	

VEARS01

Allocation of Invigilation Duties – National Qualifications 2025

Invigilator		Chief Invigilator		
Contact number		Contact number		
E-mail address		E-mail address		

Please indicate dates you are **unable** to invigilate in the table below and submit the completed form to your Chief Invigilator. This form will be returned to you with your confirmed allocations.

Actual Day and Day Number	Date	Dates Not Available		Extra Time	Allocation (Chief Invigilator use only)	
		AM	PM		AM	PM
Training day						
Day 1	Friday 25 April					
Day 2	Monday 28 April					
Day 3	Tuesday 29 April					
Day 4	Wednesay 30 April					
Day 5	Thursday 01 May					

Day 6	Friday 02 May					
No Exams Bank Holiday						
Day 7	Tuesday 06 May					
Day 8	Wednesday 07 May					
Day 9	Thursday 08 May					
Day 10	Friday 09 May					
Day 11	Monday 12 May					
Day 12	Tuesday 13 May					
Day 13	Wednesday 14 May					
Day 14	Thursday 15 May					
Day 15	Friday 16 May					
Day 16	Monday 19 May					
Day 17	Tuesday 20 May					
Day 18	Wednesday 21 May					
Day 19	Thursday 22 May					
Day 20	Friday 23 May					
Day 21	Monday 26 May					
Day 22	Tuesday 27 May					
Day 23	Wednesday 28 May					
Day 24	Thursday 29 May					
Day 25	Friday 30 May					
No Exams Contingency Day						

1
National Qualifications 2025
Modern Languages

National 5, Higher and Advanced Higher
Gàidhlig
National 5 and Higher
English for Speakers of Other Languages
National 5 and Higher
Listening exam
Instructions to person nominated to operate sound equipment

This guidance relates to carrying out a check of the CD. If your centre has opted to receive
electronic audio files you must refer to the guidance on Downloading and Securely Storing
Electronic Files which will have been issued to the nominated people in your centre.

1 Arrangements for the exam

a) Recordings will be supplied on CD or electronically via SQA's secure site.
b) You should check the room(s) to be used for the examination and the sound equipment
before the day of the examination.

The room(s) used for the examination should be sufficiently isolated from any other room
in which an examination is being held so that other candidates will not be disturbed by
the sound of the recording.

The sound equipment should be in satisfactory working order.

The sound equipment should be suited to the size of the room(s) used and/or to the
number of candidates in a group.

The optimum number of candidates in each group, and the best position for the sound equipment so that all candidates can

hear clearly, should be determined by practical experiment.

c) You are required to conduct a check of the CD prior to the examination. You will be admitted to the examination room 30 minutes before the start of the exam.

d) When you receive the CD from the invigilator, check to ensure that it states the correct subject, level, date and time of the exam.

e) You should play a **short section** of the recording to check for any faults and to adjust volume and tone as necessary.

f) No candidate is to be present or within earshot during the recording check or admitted to the room until the check has been completed.

g) On completion of the check, inform the invigilator that the CD is working correctly and is ready to play. Remain in the examination room to operate the equipment for the examination. While you are in the examination room you **must not** communicate with the candidates.**2**

2 Emergency procedure

If there is an issue playing the CD, it must first be tried on another machine. If the CD proves faulty and unusable, you must tell the invigilator who will inform the SQA co-ordinator who will contact SQA. Follow any further instructions from the invigilator.

3 Conduct of the exam

a) Start playing the CD when the

invigilator asks.
b) The CD must be left to play through without interruption*. No part of the CD may be repeated, unless specifically authorised by the invigilator.
c) In the event of an interruption which might seriously affect the candidates' hearing of the recording the invigilator may ask you to pause the CD until the interruption has passed. The invigilator may ask you to take the recording back a few seconds or to the start of a section.
Please note that if the CD is stopped, it will return to the first track. Therefore, it should be paused.
d) When the CD has been played through, you should pass the CD to the invigilator and leave the room.
*If candidates have been given an allowance of extra time, there may be a requirement to pause the CD. Please refer to the Sound Equipment Extra Time Operator's Instructions for the relevant subject/level.

alternative method to ensure that the Core Skill is still covered.

On Tue, Mar 25, 2025 at 10:49 AM tshingombe fiston <tshingombefiston@gmail.com> wrote:

y Profile

Hi fiston.

Using the navigational panel on the left hand side, you can set up, review and update the information and preferences stored in our system. We would encourage you to regularly visit your candidate account to ensure that we have the most up to date information about you as we may contact you direct when vacancies that suit your skills and experience arise.

For your own privacy, when you have finished please ensure that you log off.

Overview of applications

Job Title	Reference	Stage
Product Maintenance Manager (M365)	6163	Application Started

My Inbox

Your inbox is empty

Contact Information

- General Enquiries
- 0345 279 1000

Vacancies

- My profile
- Access details
- Personal details
- Manage job alerts
- History
- Current vacancies
- Withdraw application
- Logoff
    - Home
        - Vacancies >

From	shared.service@sqa.org.uk

To	tshingombefiston@gmail.com
Subject	SQA Registration Confirmation

Hi,

Thank you taking the time to look around the Jobs at SQA website and registering with us.

To check the status of your applications, update your contact details, register for job alerts and withdraw or amend completed applications please do this by logging into the site.

- https://jobs.sqa.org.uk/home.html

- https://appointeeopportunities.sqa.org.uk/home.html

Don't worry if you forget your password: just follow the links on the website to request a password reset. If you need any more help, please do not hesitate to contact us.

Kind regards,

Scottish Qualifications Authority

On Tue, Mar 25, 2025 at 10:41 AM tshingombe fiston <tshingombefiston@gmail.com> wrote:
The heart of Scotland's world-renowned education system. Offering globally recognised qualifications and services to realise your potential.

- Past papers
- Timetable
- Your exams
- Find NQ subjects

- Skills for Work
- HNCs and HNDs
- SVQs
- Lost your certificate?

Enter Qualification...

Search

Read our Prospectus for change

Become a marker

Latest research

News

View all

SQA rebalancing assessment for practical qualifications

SQA appoints headteacher as Senior Advisor to strengthen support for Scotland's schools

SQA websites

- Connect
- Appointees
- Secure
- SOLAR
- Academy

Modified past papers

Some of the 2022 and 2023 past papers are labelled 'modified'. This means SQA made changes to the question paper in response to the disruption caused by the Covid-19 pandemic, as part of our modifications to assessment in National Courses. For example, a modified past paper may be shorter, have fewer marks or contain fewer topics than past papers from previous years.

Specimen question papers

Specimen question papers are available for National 5, Higher and Advanced Higher qualifications. These show what a question paper looks like - how it is structured and the types of questions it contains. They also include marking instructions. Find them under 'Past Papers and Marking Instructions' on our NQ subject pages.

Digital question papers

Braille question papers

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- Home
- National Qualifications > Learner support > Timetable

Exam timetable and learner apps

Timetable 2025

2024-25 Exam Timetable (373 KB) updated 3 February 2025

- Exams start on Friday 25 April.
- They finish on Monday 2 June.
- Results day is Tuesday 5 August.

Use the tabs below to open each section individually. Alternatively you can show all the sections.

Timetable changes

If you have any queries about the exam timetable, please speak to your school, college or training provider in the first instance.

Personal timetable builder

Create your own timetable using our online version.

Build your own online timetable

Exam apps

Our MyExams app has been updated with the timetable changes made on Monday 3 February.

Important for learners whose exams have changed

- MyStudyPlan users: If you imported exams before the update, remove them in the Subjects

window (tap the edit icon in the top right, then the red icon next to each exam). After that, re-import from MyExams to get the new dates.

- Calendar users: If you exported exams to your calendar before the MyExams update, delete those entries and repeat the export again to ensure your dates are correct.
- If you are still seeing old exam dates on the MyExams app, check the app troubleshooting section below.

MyExams

- Download MyExams from the App Store.
- Download MyExams for Android.

MyStudyPlan

- Download MyStudyPlan from the App Store.
- Download MyStudyPlan for Android.

s the owners of copyright items that are not owned by SQA.

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Related Information

Documents

- Catalogue of National Qualifications (836 KB)
- Setting the Grade - SQA's awarding procedure (1.47 MB)
- NQ Annual Update (406 KB)
- Authenticating learners work good practice advice (123 KB)

Contact Information

- Candidate Enquiries
- General Enquiries

  0345 279 1000

- Centre Enquiries

0303 333 0330

External Web Links

- Education Scotland
- Scottish Credit and Qualifications Framework (SCQF)
- How Scottish Universities aim to be fair

We created Your Exams to give you information and advice to help you prepare for your exams. It also tells you what you need to know for the day of your exams, including rules you need to read and understand.

Remember to prepare, stay calm and do your best.

What you need to know about exams in 2025

- Exams start on Friday 25 April and end on Monday 2 June.
- Your school provides an estimated grade for each course before the exams start.
- An Examination Exceptional Circumstances Consideration Service is available if you cannot attend your exam, or your performance in the exam is disrupted.
- Results day is Tuesday 5 August.
- There is an appeals service that you can access directly or through your school.

Download Your Exams 2025

Your Exams - college edition (5.20 MB)

Na Deuchainnean Agad (5.07 MB)

Use the tabs below to open each section individually. Alternatively you can show all the sections.

Before your exams

Timetable

- Download the exam timetable.
- Double-check the times of your exams as schools can change the start times.
- Make sure you know what exams you're taking, when they are, and where they are.
- Ask your school which teacher will be in charge of SQA exams on the day. You need to know so you can report to them if you are late.

Past papers

- Practice with previous exam papers.
- Use the marking instructions to check your answers.

SQA Apps

- MyExams app - create a personal timetable, add notes, and add to other calendars.
- MyStudyPlan app - organise your revision by creating a personal study plan.
- Create your own personal exam timetable using the online Timetable Builder.

Info and download links

Your Scottish Candidate number

Your Scottish Candidate Number (SCN) is your personal identification number.

- You need to write it on your exam answer booklets.
- Your school can tell you what your SCN is.

Your teacher will give you an SCN card to write your name, school name, date of birth and SCN on. You can take this card into the exam room as long as you don't write anything else on it.

Check your school has the right name and address

Has your address changed?

If any of your personal details change, or are going to change over the summer, you must tell your school before you finish for the summer holidays.

You can check the personal details we hold for you by logging in to MySQA.

On exam day

Arriving for your exam

- Make sure you know when and where your exam is taking place
- Give yourself plenty of time to get there
- Have your SCN with you
- Be outside the exam room 10 minutes before the exam starts

If you're late, the teacher in charge will tell you if you can sit the exam.

How to find your Scottish Candidate Number (SCN)

Speak to your school, call us on 0345 279 1000, or complete our Candidate Enquiry Form.

Supplies

Make sure you have the necessary exam supplies, such as pens.

In the exam room

Desks

If your school allocates a specific desk for exams, make sure you know what desk number is yours for each exam.

Prohibited items

You must not take any prohibited item to your seat. You're not allowed (unless an approved assessment arrangement is in place):

- Mobile phones (even if it's switched off)
- Electronic devices such as tablets, earbuds, smartwatches or any other device that stores information or can connect to the internet
- Books, sketches or paper, and anything written on your clothes or body
- Pencil cases or calculator cases
- Calculators (except when allowed)
- Dictionaries (except when allowed)
- Notes

Check your bags and pockets to make sure you do not have any of these things with you - plan ahead and leave them in a safe place.

When specific items are allowed in an exam, you must make sure they meet SQA regulations.

You are not allowed to share any equipment during an exam.

Invigilators

Invigilators supervise the exam and make sure the rules are followed. Follow any instructions given by the invigilator and ask them for help if you feel unwell or upset.

Leaving the exam room

If you finish early or have done as much of the exam as you can, and you want to leave the exam room, raise your hand and ask the invigilator for permission to leave. If the exam is longer than one hour, the invigilator may allow you to leave after 30 minutes. If the exam is less than one hour, you must stay in the exam room until the end of the exam.

Before you leave, you must give the invigilator all your exam papers, including any answer booklets, extra sheets, question papers and data booklets. You could lose all marks for the paper concerned if you don't give your exam papers to the invigilator before leaving the exam room.

Question papers and answer booklets

1. Read the instructions on the front of your question paper
2. Check the subject and level are correct
3. Fill in your details on the front page - including your name, school name and SCN

You will get either a :

- **combined** question paper and answer booklet

or

- **separate** question paper and answer booklet

Work through the question paper until you see the statement END OF QUESTION PAPER.

In a question paper, pages that don't have any questions or instructions will say BLANK PAGE on them.

No page is completely blank. If you find a completely blank page before the END OF QUESTION PAPER statement, tell the invigilator.

Extra paper

If you need extra paper, raise your hand and ask the invigilator.

If you use extra paper, you must write your name, SCN and school name on each sheet and put these inside your answer booklet.

In some subjects, you will find extra pages or graph paper at the end of the answer booklet.

Writing your answers

You must use a **pen with black or blue ink**.

Do not use gel pens or pencils as these can fade.

It is important the markers can read your writing. They might not be able to award marks if your writing is difficult to read.

When writing on unlined pages, try to leave a space of about one centimetre between lines.

In some subjects, poor spelling and punctuation could also result in marks not being awarded. If you have any concerns about this, or about your handwriting, speak to your teacher.

Cross out any rough work, or any unwanted answers if you make more than one attempt at a question. You are not allowed to use correction pens, tape or fluid in any exam.

Remember

- Take your time.
- Read the question carefully.
- Answer the question being asked.
- Double check your answers if you finish early.
- Stay calm and do your best.

Using calculators and dictionaries

You can only use calculators and dictionaries in specific subjects and levels.

When can you use a calculator?

You can use a calculator in the subjects listed below:

Subject	Level	Notes
Accounting	All	
Applications of Mathematics*	National 5	Paper 2 only

Applications of Mathematics*	Higher	
Gnìomhachas Matamataigs*	Nàiseanta 5	Pàipear 2 only
Gnìomhachas Matamataigs*	Àrd-Ìre	
Biology	All	
Business Management	All	
Chemistry	All	
Computing Science	All	
Economics	All	
Engineering Science	All	
Environmental Science	National 5 and Higher	
Geography	Advanced Higher	
Cruinn-eòlas	Àrd-Ìre Adhartach	
Graphic Communication	All	
Human Biology	Higher	
Mathematics*	All	Paper 2 only
Matamataig*	All	Pàipear 2 only
Mathematics of Mechanics	Advanced Higher	
Physics	All	
Practical Cookery	National 5	
Practical Electronics	National 5	
Practical Metalworking	National 5	
Practical Woodworking	National 5	
Statistics	Advanced Higher	

Download

Some learners may be allowed to use a calculator in the non-calculator papers for Mathematics or Applications of Mathematics, or for Gaelic Medium Matamataig or Gnìomhachas Matamataigs as part of an assessment arrangement. The calculator must be a basic calculator and not a scientific calculator. A basic calculator should perform the four basic arithmetic operations only and should not have the function to calculate the square root of a number. Please note that calculators containing the following keys are allowed: %, +/-, M-, M+, and MRC.

Please speak to your teacher or lecturer if you have any questions about the type of calculator allowed.

When can you use a dictionary?

You can use a dictionary in the subjects and levels listed below:

Subject	Level	Notes
Cantonese	National 5	Reading and Writing
Cantonese	Higher	Reading and Directed Writing
Cantonese	Advanced Higher	Reading and Translation
Cantonese	Advanced Higher	Listening and Discursive Writing
French	National 5	Reading and Writing
French	Higher	Reading and Directed Writing
French	Advanced Higher	Reading and Translation
French	Advanced Higher	Listening and Discursive Writing
Gaelic (learners)	National 5	Reading and Writing
Gaelic (learners)	Higher	Reading and Directed Writing
Gaelic (learners)	Advanced Higher	Reading and Translation
Gaelic (learners)	Advanced Higher	Listening and Discursive Writing
German	National 5	Reading and Writing
German	Higher	Reading and Directed Writing
German	Advanced Higher	Reading and Translation
German	Advanced Higher	Listening and Discursive Writing
Italian	National 5	Reading and Writing
Italian	Higher	Reading and Directed Writing
Italian	Advanced Higher	Reading and Translation
Italian	Advanced Higher	Listening and Discursive Writing
Mandarin Simplified	National 5	Reading and Writing
Mandarin Simplified	Higher	Reading and Directed Writing
Mandarin Simplified	Advanced Higher	Reading and Translation
Mandarin Simplified	Advanced Higher	Listening and Discursive Writing
Mandarin Traditional	National 5	Reading and Writing
Mandarin Traditional	Higher	Reading and Directed Writing
Mandarin Traditional	Advanced Higher	Reading and Translation
Mandarin Traditional	Advanced Higher	Listening and Discursive Writing
Spanish	National 5	Reading and Writing
Spanish	Higher	Reading and Directed Writing
Spanish	Advanced Higher	Reading and Translation
Spanish	Advanced Higher	Listening and Discursive Writing
Urdu	National 5	Reading and Writing

Urdu Higher Reading and Directed Writing
Download

Conduct

Everyone should have a fair chance to do their best during exams.

Cheating and causing a disturbance during an exam are unfair to other candidates. Examples of cheating and unfair behaviour include:

- Having prohibited items with you
- Pretending to be someone else or getting someone else to take an exam for you.
- Disruptive behaviour in the exam room.
- Using rude, abusive, offensive or discriminatory language or images in your answers.
- Copying from another person.
- Collusion - working with other candidates on an individual task that must be your own work.
- Plagiarism - failing to reference sources properly or presenting someone else's work as your own, which includes using artificial intelligence programmes such as ChatGPT to create responses.

Any cheating or unfair behaviour can have serious consequences for your results.

This could include losing marks, getting a lower grade or having your qualification cancelled. Your school can explain more about this.

Exam day checklist

Do

- Do arrive in good time - at least 10 minutes before the exam starts.
- Do bring the right equipment - including black or blue ink pens.
- Do check that you don't have any prohibited items with you at your seat.
- Do check you have been given the correct exam paper.
- Do put your name, SCN and the name of your school on every piece of work you hand in (including separate answer booklets and answer sheets).
- Do write legibly so markers can read your answers.
- Do read instructions and listen carefully for any announcements from the invigilator.
- Do cross out any rough work that is not part of your answer.
- Do stay in the room until the exam is finished. You can only leave early with permission from the invigilator.
- Do give the invigilator all your exam papers, including any answer booklets, extra

sheets, question papers and data booklets, before you leave the exam room.

Don't

- Don’t get someone else to sit your exam for you or pretend to be someone else.
- Don’t take any prohibited items to your seat.
- Don’t behave in a disruptive way or cause a disturbance.
- Don’t copy from anyone else.
- Don’t share your work with anyone else.
- Don’t share equipment with anyone else.
- Don’t use any rude, abusive, offensive or discriminatory language or images in your answers.
- Don’t use correction pens, tape or fluid.

After your exam

What if I couldn't sit the exam?

You or your parent or carer should contact your school as soon as possible, explaining what has happened.

They will be able to discuss your options and whether or not you would be entitled to use the Examination Exceptional Circumstances Consideration Service. If you are eligible for the service, your school would need to contact us.

Exam Exceptional Circumstances Consideration Service

This Service will support you if:

- you have been unable to attend the exam, or prevented from completing the exam, due to a personal circumstance beyond your control (such as a medical issue)
- you have been affected during the exam by a disruption, or other exam circumstance, reported by the chief invigilator
- your performance in the exam was affected by a personal circumstance, or an unplanned incident on the day, which was beyond your control.

Exam nerves, distraction or loss of concentration during an exam are not valid reasons to use this service.

Your school must request the service for you within 10 days after the exam, so it’s important that you speak to them as soon as possible after the exam, giving them the information about what happened. You must give your school permission to request the service.

Your school will then need to provide alternative evidence based on the assessments you completed throughout the year. This could be prelims, class tests, class work, records of performances (in some subjects). SQA examiners will review this, and any exam materials that you completed, to decide your grade.

If you use the EECCS, the grade you are awarded may be different from the estimated grade provided by your school. You will not be able to appeal against your grade through the appeals service.

More on the exceptional circumstances service.

Results

You get your results by post on Tuesday 5 August.

You can also get your results by text, email or both if you sign up to MySQA

Your school will also receive your results.

If you have applied to a university or college through UCAS, they will also receive your results.

If you don't receive your certificate on results day, contact your school immediately. They can tell you your results and will work with us to find out what has happened to your certificate.

If you think there's a mistake on your certificate, or something looks wrong, contact your school.

MySQA - results by text/email

MySQA is where you can:

- see your qualifications
- check the personal details we hold for you
- get your results sent by text, email or both

You'll need to sign up at MySQA by **5pm on Wednesday 16 July** (you need an email address and your SCN).

You will still receive your certificate by post.

Remember, if you change your mobile number or email after signing up, you'll need to update your details to receive your text message or email.

On results day, if you cannot find yo

[Download Your National Qualifications]

College edition

Your National Qualifications (4.62 MB)

Gaelic edition

Your National Qualifications Gaelic (2.07 MB)

Completing your coursework

There are rules you must follow when you are completing your coursework.

Use the tabs below to open each section individually. Alternatively you can show all the sections.

What types of coursework are there?

The type of coursework you will do depends on what subject you are studying.

These can be;

- A portfolio
- Practical activities
- Performances
- Assignments
- Projects

Only hand in your own work

You must only submit your own work. Passing off other people's work and ideas as your own is called 'plagiarism' and it's cheating.

It's not your own work if:

- all or some of it has been done, or worked on, by someone else
- it has been done by someone who has produced similar work in the past (such as an older student)
- you use work that your teacher has prepared as an example
- you've copied it from a source, such as a book, website or an essay bank, without trying to put it in your own words or referencing it
- you've copied text, images or any other material produced by an AI tool.

Working with others

Unless you are working as part of a group (for example, on a group project), you must work alone to complete your coursework. If someone asks you for help, you should tell them to ask a teacher instead.

If you are finding any part of your course difficult, ask your teacher for advice. No other person can be involved, at any stage, in discussing or reviewing your coursework.

How to use sources

You may be able to use lots of different sources (including books, the internet and TV programmes) in your work, but it's important that you reference them correctly.

When using sources, the general rules are;

- Use 'quotation marks' around any text that has come from other sources and clearly say where that text is from.
- Provide a reference for any diagrams or illustrations you've used from other sources.
- Create a bibliography (a list of sources you have used). This will go at the end of your work.

Your teacher will be able to help if you get stuck.

Can I use Artificial Intelligence (AI)?

No. You might have heard about or used artificial intelligence (AI) tools such as ChatGPT or Google Bard. Many of these AI tools have age restrictions, which means they are not suitable for everyone. The text they produce can be incorrect or contain biased information. As the

information is not reliable, **you must not use or reference AI tools as sources for your work**.

Find out more about our policy on AI in assessments.

What if I break the rules?

If an investigation finds you've broken any rules, there may be a penalty, which could include the following.

- Your marks can be reduced, or you can be awarded zero marks.
- Your qualification for that subject can be cancelled.
- All of your qualifications for the e
  - Home
  - National Qualifications > Learner support > Private candidates

Information for private candidates (home-schooled)

Private candidates include home-schooled learners who are taught by a parent, carer, or tutor.

If you are a private candidate and you wish to take SQA qualifications, you need to be entered for the qualifications by an SQA approved centre (such as a school, college, or training provider) that will act as your presenting centre.

What does a presenting centre do?

Your presenting centre will register you for your chosen qualifications and arrange for you to complete the required assessments, including any exams or coursework. They are also responsible for making sure that you complete your assessments under the conditions required by SQA – for example, under direct supervision or completing the assessment within a time limit.

How do I find a presenting centre?

You can contact your local schools, colleges and training providers and ask if they can act as your presenting centre. You can also approach your local authority education department. We strongly advise doing this as early as possible before the start of the academic year.

When you contact a centre, make sure you provide them with details of the qualifications you are looking to be entered for, including your chosen subjects. The centre will advise if they are able to enter you for those qualifications.

The centre may also arrange a discussion with you to find out more and to explain what's involved.

Is there anything I need to discuss with the centre?

At an early stage, you should ask the centre about the assessments you will need to complete for your chosen qualifications. They will advise you what coursework and/or exams you will need to do and when these will take place.

If you are disabled and/or have additional support needs, you should also discuss these with the centre as soon as possible, so that they can agree appropriate assessment arrangements with you and ensure they are put in place.

If they agree to act as my presenting centre, what happens next?

Once a centre has agreed to present you as a private candidate, they will ensure that you are registered with SQA and have a Scottish Candidate Number (SCN). The centre will enter you for your chosen qualifications and provide you with all the information you need to know about your assessments – including coursework, any tests or internal assessments that take place throughout the year, and details of any exams you will be sitting.

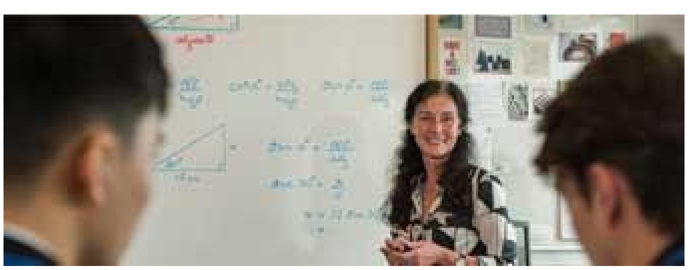
They will also explain the rules and essential information you need to know about your coursework and assessments. It is important that you understand

ntire year can be cancelled.

- Home
- National Qualifications > NQ teaching support > Teaching support

Teaching resources

Support and resources for delivery of National Qualifications including internal assessment materials, exam support and contact details.



[Internal Assessment Support Materials]

[Download Internal Assessment Support Materials.]

[Exam support and forms]

[Forms and supplementary materials for the exam diet, including the scaling calculator, flyleafs and change requests.]

- Home
- Qualifications > Assessment Support Materials

Internal Assessment Support Materials

NQ — UAS

February 2025 monthly update

NQ — UAS support materials full list

For every National Unit, we have published a corresponding Unit assessment support pack that shows a Unit-by-Unit approach to assessment, a few subjects such as Maths and Literacy

have more than one of these. For National Courses, we have also published Unit assessment support packs that show combined and portfolio approaches.

Please note that Unit assessment support packs will be updated during the session and, as such, we advise that you use the most up-to-date versions with your candidates. Details of updates to Unit assessment support packs and other documents can be found in our Notification of Changes spreadsheets.

- Unit Assessment Support Publication List currently being revised - to be added here soon

HN — ASP

February 2025 monthly update

The following Assessment Exemplar/Assessment Support Pack materials have been added, replaced or revised in February 2025. To access these materials via our secure website, please speak to the SQA co-ordinator in your centre.

Social Sciences

Level	Title	Publication Code	New/Revised
6	Social Anthropology: Who does it and how to do it	HG55 33/ASP001	New

Download

Travel and Tourism

Level	Title	Publication Code	New/Revised
7	Working as Senior Air Cabin Crew	J7LJ 34/ASP001	New

Download

HN ASP full list

NQ — NAB/ASP

February 2025 monthly update

The following Assessment Exemplar/Assessment Support Pack materials have been added, replaced or revised in February 2025. To access these materials via our secure website, please speak to the SQA co-ordinator in your centre.

Built Environment

Level	Title	Publication Code	New/Revised
6	Health and Safety in the Construction Industry	H669 46/ASP001	Revised

Download

Computing IT and Related Areas

Level	Title	Publication Code	New/Revised
6	Digital Media: Still Images, Digital Media Audio and Digital Media: Moving Images	HW4X 46, HW4W 46 and HW4Y 46/ASP001	Revised

Download

English

Level	Title	Publication Code	New/Revised
5	Introduction to Literature	J4G8 45/ASP001	Revised
6	Literature 1	FA58 12/ASP001	Revised

Download

NAB, ASP, PBNC and Skills for Work full lists

HN/NQ Centre Devised Prior Verified Assessments

Centre Devised Prior Verified Assessments full list

The following document lists all HN and NQ centre devised assessments currently available. To access these materials via our secure website, please speak to the SQA co-ordinator in your centre.

- Centre Devised PV Publication List (119 KB)

SVQ — Assessor's Guidelines/Portfolio

February 2025 monthly update

There were no SVQ - Assessor's Guidelines/Portfolio materials added, replaced or revised in February 2025.

SVQ support materials full list

Training and Assessment Packs

February 2025 monthly update

There were no Training and Assessment Packs Assessor's Guidelines/Portfolio materials added, replaced or revised in February 2025.

TAPS support materials full list

Digital Assessment Support Materials

SOLAR Assessments

A list of subjects with Digital Assessment Support Materials provided by SOLAR.

HN Guidance Notes and Blank Checklists

These documents should be used in conjunction with Assessment Exemplars downloaded from the secure website.

- Guidance Note: Introduction and How to Generate Evidence (70 KB)
- Blank Class Checklist: Four Outcomes (57 KB)
- Blank Class Checklist: Three Outcomes (54 KB)
- Blank Class Checklist: Two Outcomes (54 KB)
  - Home
  - National Qualifications > NQ teaching support > Exam support and forms > Exam support

Exam support and forms

Forms and materials support during the exams:

Accommodation arrangements

- Accommodation arrangements (124 KB)

Allocation of duties

- Allocation of duties (355 KB)

Attendance register

- [VE Attendance register supplement (additional candidates)] (51 KB)
- [Attendance register supplement (notes)] (49 KB)

Flyleafs

- [2025 Exam Flyleafs]

Invigilator

- [Invigilator Report Form] (266 KB)

Sound equipment - music and languages

- [Languages Sound Equipment Operator's Instructions] (131 KB)
- [Music and Music Technology Sound Equipment Operator's Instructions] (129 KB)

Scaling calculator

The scaling calculator can be used as an aid to calculate the total mark for National 5, Higher or Advanced Higher courses that have scaled components.

- [Scaling calculator 2025] (110 KB)

Estimates

Guidance for practitioners explaining what estimates are, with examples of assessment evidence needed.

[Liaison team]

[The Liaison team provide support and advice to every school and college.]

[SQA Connect]

[Access services that provide delivery and operational support for our qualifications]

ur results email in your inbox, please check your spam or junk folder.

Developing learners' skills through National Qualifications, Core Skills and Awards

It is important that learners develop a broad set of skills alongside their subject-based studies.

[Core Skills]

[A group of five skills key to learning and working in today's world.]

[NQ Core Skills]

[Core Skills are automatically certificated in some National Courses]

[SQA Awards]

[Practice-based qualifications providing skills and recognition for a range of learners.]

[Literacy and Numeracy]

[National literacy and numeracy units have a specific focus on developing literacy and numeracy skills.]

[National Certificates](#)

[Aimed at 16-18 year olds they develop transferable knowledge including Core Skills.](#)

QA Awards

SQA Awards are practice-based work qualifications for specific sectors, providing skills and recognition for a diverse range of learners.

- British Sign Language
- Counselling / Advice /Crisis work
- Customer Service
- Cyber Security Fundamentals
- Education / Training / Teaching
- Employability
- First Aid
- Fix and Secure Memorial Masonry
- Forestry / Timber production
- Health / Social care / Caring

- Health and Safety in a Construction Environment
- Hospitality / Catering
- Internet Safety
- Languages / Cultural Studies
- Personal Finance
- Personal and Social Development
- Principles and Practice of the Cremation Process
- Religion, Belief and Values
- Sports Coaching
- Wellbeing

NQ Statistics Award at SCQF level 6

- Deliver qualifications
- Past papers
- About SQA
- Contact us

- Deliver qualifications home

- Quality assurance

- Case studies

- Customer support team

- Consultancy services

- Home
- Deliver qualifications > Become a centre

Become a centre - offer your first SQA qualification

To offer SQA qualifications you must first become an approved SQA centre. This ensures each organisation delivering SQA qualifications has the right set-up and meets quality standards to deliver for learners.

Below you will find more information about the approval process.

Our dedicated team are here to support you and your organisation through the process. You'll be assigned a point of contact who will answer any questions you may have and keep you up

to date on the progress of your application.

Why choose SQA?

We offer internationally recognised qualifications and services at affordable prices with solutions that are right for you.

About us

- 100 years' experience in qualification design
- an awarding body with a global reputation for quality
- national accreditation and awarding body (Ofqual recognised)
- experts in assessment

Internationally recognised qualifications

We offer a portfolio of regulated, non-regulated and bespoke qualifications and assessments that are relevant and flexible, embedding and instilling industry standards in over 30 sectors.

Named Account Manager

All SQA Approved centres are assigned their own Account Manager - a personal contact who will take time to learn about you and your business.

Expert customer support team

In addition to your named contact, you'll have the help and support of our experienced customer team ready to take your calls.

Value for money

You'll benefit from our simple pricing structure; there are no annual fees and we don't charge for External Verifier visits. We operate on a 'pay-as-you-go' basis with no minimum spend.

Trusted subject experts

All of our External Verifiers are subject specialists guaranteeing the highest standards of quality assurance through an in-depth knowledge of your sector.

Read our case studies

We have a growing selection of case studies from our customers to help you decide if working with SQA is right for you.

Approval application process

Contact us

Complete the [enquiry form](#).

Pre-application stage

We'll meet with you to discuss becoming an SQA Centre, including if it's right for your organisation.

If you would still like to apply after that, we'll then send further information and carry out due diligence, including a soft finance check.

Application stage

Next, we send you the relevant documents and forms to apply for the two parts of approval:

1. **Systems approval** – this confirms that your centre has management and systems needed to deliver, assess and internally verify SQA qualifications.
2. **Qualification approval** – this confirms that your centre has the materials and resources to deliver, assess and internally verify SQA qualifications.

Application review stage

We'll review your application. This includes:

- a centre approval meeting by a Quality Enhancement Manager and
- a subject approval meeting by a subject expert External verifier.

After review, the Quality Enhancement Manager and External Verifier will submit a report and communicate any feedback and recommendations to you.

Outcome - centre approval

There are two possible outcomes: 'approved' or 'not yet approved'.

- **Approved** - We'll provide a centre operating agreement (COA), which you must sign and return to SQA. We then issue your centre number, and you can start registering candidates.
- **Not yet approved** - We'll offer to help you re-apply.
    - Home

- Past Papers

Past papers and marking instructions

Find past papers and marking instructions for your revision. You can search by topic and or refine by subject and level. To add the matching marking instructions simply tick the box.

We provide up to five years of past papers.

Subject:

Search: Level: Include Marking Instructions

Modified past papers

Some of the 2022 and 2023 past papers are labelled 'modified'. This means SQA made changes to the question paper in response to the disruption caused by the Covid-19 pandemic, as part of our modifications to assessment in National Courses. For example, a modified past paper may be shorter, have fewer marks or contain fewer topics than past papers from previous years.

Specimen question papers

Specimen question papers are available for National 5, Higher and Advanced Higher qualifications. These show what a question paper looks like - how it is structured and the types of questions it contains. They also include marking instructions. Find them under 'Past Papers and Marking Instructions' on our NQ subject pages.

Digital question papers

Question Papers in Digital Format for candidates with disabilities and/or additional support needs.

- Digital Question Papers

Braille question papers

- Braille question papers

- Home
- About SQA

About us

We provide products and services in skills, training and education which positively impact on individuals, organisations and society.

What we do

We have two main roles: accreditation, and awarding qualifications.

Who we are

Our organisational and leadership structure.

[Statistics](#)

[Find Attainment, Grade boundaries and component marks for National Qualifications.](#)

[SQA careers](#)

[Find out about working at SQA, available jobs and how to apply.](#)

[Prospectus for Change - Corporate Plan](#)

[See our ambitious blueprint for Scotland's new qualifications body.](#)

Access to information

How to request your personal information or get information about SQA

- Home
- About SQA > Research > SQA research

SQA research

Our Policy, Analysis and Standards team is responsible for commissioning, carrying out and collating research to inform and support all aspects of SQA's activities.

Rebalancing assessment research

The balance of approaches to assessment across National Qualifications.

Education reform

Our research contributing to the review and changes happening in education in Scotland.

2023 Awarding

Learners and practitioners research on 2023 awarding of National 5, Higher and Advanced

Highers.

Find SQA research

Evaluations, reports and research which informs and supports our work.

Generative AI Research

Analysis of the Generative AI Consultation Survey conducted in November 2023.

NextGen: HN Evaluation Research

Research reports on suitability of NextGen: HN design principles.

Assessment Arrangements research findings

Our research into how our assessment arrangements service works.

Have your say

We're looking for learners, parents and carers, and educators to take part in surveys and other research.

Code of Research Practice

The core principles for SQA research; ensuring it is useful, reliable, ethical, equitable and

sustainable.

Key audience research

The views of key audience groups about SQA and its qualifications.

SQA careers

The Scottish Qualifications Authority (SQA) is the national accreditation and awarding body in Scotland. This means we develop, design, quality assure, certificate and regulate the delivery of qualifications in Scotland.

Where we are

We operate over two sites in Scotland — Dalkeith and Glasgow. We also have colleagues based across the UK and internationally.

Our values

Our people are committed to supporting learners and education providers, whilst supporting the Scottish education system. We have a variety of roles in the business that support this activity. We look for talented individuals who share our values:

- Trusted
- Progressive
- Enabling

Vacancies

[Find out what opportunities are available for working at SQA.]

[Appointee opportunities]

[Provide vital support for SQA by joining us as an appointee. View the opportunities available.]

[Benefits]

[Annual leave, financial and pensions benefits.]

[Working for us]

[We promote and support equalities, staff development and support our community.]

The information that you have provided to SQA will be used to process your application as well as for monitoring and statistical purposes. If you are appointed this information will form part of your employee/appointee/consultant record. Further information about how SQA uses your information can be found in SQA's Privacy Statement.

On Mon, Mar 24, 2025 at 3:20 PM tshingombe fiston <tshingombefiston@gmail.com> wrote:

SQA Academy

Search tags

Search tags

2012

- 2013
- 2014
- 2015
- 2016
- 2016/2017
- 2017
- 2017 - Awarding Procedures
- 2017 - Item Analysis
- 2017 - Script Scrutiny
- 2017 - Statistical Information
- 2018
- Accessibility
- Administrator
- Appointee Handbook
- Appointee Management
- Appointees
- assessment
- Awarding Meetings
- Business World
- Candidate Advice Line
- Candidate performance statistics
- Care
- Career development
- CfE
- Changes in Legislation

- Children and Young People
- Cohort Information
- Commentaries
- component
- computer
- Continuing Professional Development
- Course Assessment
- CPD
- CSS
- Differentiation
- Digital
- Diversity
- e-Marking
- Education
- eLearning
- Electronic Images
- English Reading
- eQuality
- Equality Act (2010)
- ESOL
- EV
- EVC
- EVs
- Exception
- Exceptions table
- External Verification
- External Verifier
- External Verifiers
- Familiarisation
- faq
- Forum
- glossary
- Guide MFI Standardisation Setup
- Handbook
- Harassment
- HealthCare
- HNC Childhood Practice
- HNC Social Services
- holistic judgement
- HTML
- Image
- Induction

- Practice
- Principal Assessors
- Protected Characteristics
- QA
- Qualification
- Quality assurance
- Quality assurance model
- Question Paper
- reference data
- Repair
- RM Assessor
- Scoris
- SCQF 5
- Seeded
- Senior External Verifiers
- setting a grade boundary
- SEVs
- Silverlight
- Simulation
- Social Services
- Software Development
- SQA
- SSCYP
- STA
- Standards adherence
- Standards Testing Agency
- statistical analysis pack
- statistical materials
- Structured
- Subject
- Supervisor
- SVQ
- SVQs in HealthCare
- SVQs in Social Services
- Technology
- Technology Enabled Care
- Tips
- Type
- Unstructured
- Victimisation

Showing 150 most popular tags

ft

fiston tshingombe

User profile

Blocks

User details

- Edit profile
- Email address
  tshingombefiston@gmail.com (Hidden from everyone except users with appropriate permissions)
- Interests
  - Course Assessment

Privacy and policies

- Contact the privacy officer
- Data requests
- Export all of my personal data
- Delete my account
- Policies and agreements

Course details

- Course profiles
  - CPD for centre staff/students participating in HNCs/SVQs in Social Services, Childhood Practices and Healthcare 2019/2020
  - Delivering and Marking SQA Advanced Qualification Graded Units
  - Personal Finance Award SCQF Level 6
  - Developing a Coaching mind-set
  - Art & Design Question Paper Marking

Miscellaneous

- Blog entries
- My certificates
- Forum posts
- Forum discussions
- Learning plans

Reports

- Browser sessions
- Grades overview

Mobile app

- This site has mobile app access enabled.
  Download the mobile app.

  ft

  fiston tshingombe

  Private files

  You have currently used 38.4 MB of your 100 MB limit.

  Files

  Files

  Maximum size for new files: 100 MB, overall limit: 100 MB

  Files

  Select all/none

Select file 'thesis work experimental'	thesis work experimental	24/03/25, 12:40		
Select file 'assessment scotish.docx'	assessment scotish.docx	3/07/24, 13:05	7.7 MB	Word 2007 document
Select file 'engineering .docx'	engineering .docx	29/10/23, 09:55	14.8 MB	Word 2007 document
Select file 'tshingimbe.docx'	tshingimbe.docx	1/07/24, 13:51	8.5 MB	Word 2007 document
Select file 'tshingombe.docx'	tshingombe.docx	1/07/24, 13:51	6.0 MB	Word 2007 document

  Form actions

Skip to main content

SQA Academy

- Home
- Dashboard
- My courses
- Course categories
- Get help
- Contact form

Collapse General

- SQA logo
- General
- Welcome

Collapse Unit 1: Money Management

- Task 1: Taxation
- Task 2: Methods of payment, savings and investments
- Task 3: Legal, social, ethical and religious issues
- Task 4: Insurance, welfare benefits
- Task 5: Pensions, wills and estates

Collapse Unit 2: Personal Finance in Action

- Task 1 - Budgeting
- Task 2 - Car payments, energy bills
- Task 3 - Property, Purchase and rental
- Task 4 - Borrowing
- Task 5 - Inflation, interest and exchange rates

Collapse Feedback

- Feedback

Personal Finance Award SCQF Level 6

- Course
- Competencies
- More

Topic outline

- General

  - Welcome to Personal Finance Award SCQF Level 6, fiston

    Please select the module below to get started.

  - Introduction

    This pack is designed for learners studying the Level 6 Personal Finance Award. The Award is made up of two units:

    1. Money Management

    2. Personal Finance in Action

    To gain the Award learners must achieve **both** units.

    Once learners have studied the content of the units, they will sit their final assessments via SQA's on screen assessment system (SOLAR).

    This pack is intended to help learners become familiar with the terms used in financial products and services and understand more about how they work and what they are used for before they sit their final assessment. Questions included in the final assessment will draw from the content of units one and two.

    Learners can use the explanations and descriptions given within this pack as a starting point for further investigation into the various topics covered, or they can use it as a reminder of the various topics covered.

    PLEASE NOTE

    Where terms are defined in this document by giving examples of specific values that might apply, the values given are usually based on 2021-22 rates. For example: VAT; Income Tax Bands; Land and Buildings Transaction

Tax rates; ISA savings limit; Capital Gains Tax threshold; etc. Learners must be aware that the government has the authority to increase or decrease tax and threshold rates each year depending on inflation and other economic, societal or political factors.

-

Unit 1: Money Management

SCORM packages: 5

-

Unit 2: Personal Finance in Action

SCORM packages: 5

- Feedback
    -

      Feedback URL

SQA Staff Induction Dashboard

This sections contains links to all modules which are required to be completed by staff as part of their induction.

Understanding SQA

This sections contains links to all modules which are required to be completed by staff as part of their induction.

Last updated 16 August 2023.

Health & Safety

Dignity at Work

This course is for SQA staff, the aim of this course is to identify the definition of Dignity at Work and explain how our values, culture and policies help us all to take responsibility to create and support a respectful, equal, and fair working environment.

Autism Awareness

Our Culture

Anti-Bribery & Corruption

This Anti-Bribery Training module has been designed to be used by anyone who could be exposed to bribery and/or corruption. It explains what bribery is and helps to increase understanding of situations where gifts and hospitality shouldn't be offered or accepted.

Protecting Information

1. Courses
2. SQA Staff
3. Develop yourself

Develop yourself

- Category
- More

Course categories

Search courses

Develop yourself

Courses for staff looking to develop their knowledge and skills.

Recruitment Essentials

ISO and our Management Systems

Going Digital

Scotland's Languages

This course is for SQA Staff. If your a member of staff and cannot access the course, please contact das.helpdesk@sqa.org.uk

Your Development, Your Choice

A guide to owning your development in the workplace

Complaints Handling

SQA staff guide to handling complaints.

My Carbon Impact

This course is for all SQA staff and aims to raise your awareness of the environmental impact of everyday activities and the ability to reduce emissions, on an individual and organisational basis. The course will also develop your understanding of the wider challenges facing Scotland, the UK and the world as a result of the climate emergency.

[A Guide to Remote Working]

SQA Staff guide to Remote Working

[Change Management]

This course is for SQA staff. Please contact the OD and Change Practitioners if you have any questions.

[Clear and Confident Writing]

Here you'll find modules to help you write more effectively for your audience.

[Managing Stressful Situations at Work]

This course is designed to support SQA colleagues when managing stressful situations at work.

[Mental Health Matters]

This course is designed to support SQA colleagues understand Mental Health and provide guidance on when and how to seek support, if needed.

[My Review]

Audience: SQA Staff

Course owner: Organisational Development

Contact: odchange.team@sqa.org.uk

Resilience

This course is designed to support SQA colleagues understand the definition of Resilience and how to put it into practice.

Virtual Meeting Facilitation

We've gathered the following tips and best practices to support all staff members who are hosting and facilitating virtual meetings for colleagues, and stakeholders, inside and outside of SQA.

1. Courses
2. SQA Staff
3. Equalities

Equalities

- Category
- More

Course categories

Search courses

Equalities

Welcome to the Equalities section.

Equality, Diversity & Inclusion Training

This training aims to provide an overview of the Equality Act 2010, its impact for SQA and your responsibilities.

[Introduction to WCAG (Web Content Accessibility Guidelines)]

This short course will develop your understanding of Web Content Accessibility Guidelines (WCAG) and how you can apply them in your work.

[Designing Inclusive Assessment]

Designing Inclusive assessment

[Equality Impact Assessment]

This SQA course explains how Equality Impact Assessments are a valuable tool in creating and developing policies and practices which consider how what we do impacts on people, and specifically people with Protected Characteristics. Equality Impact Assessments allow us to create policies and practices which are inclusive and provide us with the opportunity to embed equalities into wider decision making.

[Digital Accessibility Training]

This course is aimed at SQA staff

Upon completion of this course, users should be able to:

- Name relevant legislation underpinning accessibility measures.
- Demonstrate familiarity with two key acronyms: UDL (Universal Design for Learning) and WCAG (Web Content Accessibility Guidelines).
- Demonstrate knowledge of how to make documents and slideshows more accessible.
- Identify and use free software or software features to check and enhance the accessibility of documents and slideshows.
- Audit their everyday practice for accessibility and embed appropriate accessibility

techniques.
- Identify individuals within the organisation who would benefit from sharing good accessibility practice.

Care Experience and Corporate Parenting

This is an introductory course to help learners understand more about care experience and their responsibilities as Corporate Parents. All images featured are the copyright of Who Cares? Scotland unless stated otherwise.

Course categories

Search courses

Information Governance

Welcome to the Information Governance section of SQA Academy.
Please select a course below to access it.

Freedom of Information

Records Management

1. Courses
2. SQA Staff
3. Line Management

Line Management

- Category
- More

Course categories

Search courses

Line Management

Line management courses for any staff with line management responsibilities, or who are interested in line management.

Please select a course below.

[Line Manager Fundamentals]

1. Courses
2. SQA Staff
3. Organisation roles

Organisation roles

- Category
- More

Course categories

Search courses

Organisation roles

We have training for specific roles or tasks within SQA.
Please select a course below.

Benefits Management

Candidate Advice Line Training 2024

This training course is for 2024 CAL volunteers. You will find out more information on the processes involved, as well as helpful tips on providing excellent customer service.

Data Governance Training Programme

Business Continuity

Procurement C.S.M. training

About

This course is about Procurement Contract and Supplier management.

Audience

This course is aimed at the Procurement team, however all SQA staff are able to access the training.

Workplace Investigations

This course is mandatory training for colleagues who are going to be conducting a workplace investigation at SQA.

This course must be completed prior to conducting any workplace investigation.

This training book can also be used as a reference guide for investigators once they have completed the training.

Risk Management

1. urses
2. SQA Staff
3. Qualifications Development

Qualifications Development

- Category
- More

Course categories

Search courses

Qualifications Development

We have training for tasks completed by the Qualifications Development directorate. Please select a course below.

Finalisation

1. Courses
2. SQA Staff
3. DAS Staff Training

DAS Staff Training

- Category
- More

Course categories

Search courses

DAS Staff Training

Welcome to the DAS staff training section.

SQA Academy staff training

This course contains training and guidance for SQA Academy team members.

Helpdesk Training

This course has been designed as a resource to support DAS Helpdesk staff to resolve enquiries relating to the SQA Academy.

Marker Check

1. Courses
2. SQA Staff
3. NQ Assessment and Data Services

NQ Assessment and Data Services

- Category
- More

Course categories

Search courses

NQ Assessment and Data Services

Courses for NQ Assessment and Data Services

E-Marking Helpdesk Training

Supervisor Training

Podcasts

- Category
- More

Course categories

Search courses

Podcasts

Tune into a podcast and learn something new while you work

Academy Podcast

Learn while you work with Academy Podcasts. Each month we'll discuss all the things digital with guests from across the organisation.

Podcast guidance

Welcome. Here you will find learning and materials relating to Contract Ops.

Protecting Information (Contract Ops) 2024

SQA Academy

Course categories

Search courses

Expand all

Assessment Development Fundamentals for Vocational Qualifications

External Agencies

International

Joint SQA/External Agencies

NextGen: HN

Open courses - available to everyone

SQA Appointees

SQA Centres

SQA Staff

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SQA Academy

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Collapse

- Welcome
- Developing Vocational Assessments
- Selecting Valid Assessment Methods for Vocational Qualifications
- Developing Multiple Choice Assessments for HN/VQ
- Feedback

Assessment Development Fundamentals for Vocational Qualifications

- Course
- Competencies
- More

You are enrolled in the course.

Topic outline

-
    - Welcome to Assessment Development Fundamentals for Vocational Qualifications, fiston

      Please select one of the modules below to get started.

    - Developing Vocational Assessments SCORM package

-
    -
    - Feedback URL

-
- Selecting Valid Assessment Methods for Vocational Qualifications SCORM package

-
-

    Developing Multiple Choice Assessments for HN/VQ SCORM package

Standards and Testing Agency (STA)

This module is designed to support SQA staff and Qualification Development Specialists (QDS) in developing assessments for our vocational and externally regulated qualifications, however it provides content applicable across our portfolio.

By completing this module, you will:

- become familiar with the basics of assessment theory
- become familiar and compliant with SQA HN/VQ assessment development processes
- be given some practical assessment development advice

Throughout the module there will be some reflection points and an end of course test to consolidate your knowledge and understanding, to prepare you for developing your own assessments.

This module should be used in conjunction with 'SQA's Code of Practice, Assessment: A Guide for Regulated Qualifications' and the HNVQ Assessment Development Process dependent on whether this a paper based or online assessment. The full process for our paper based and online assessments is available on request from the Assessment Materials and SOLAR teams.

On Mon, Mar 24, 2025 at 11:47 AM <web.team@sqa.org.uk> wrote:

MyAlerts

Dear Tshingombe ,

There have been no recent updates to the content you have subscribed to on the SQA website.

To change your page selection / frequency, or to unsubscribe, log in to your MyAlerts account.

You receive this update because you are subscribed to MyAlerts. This email is intended for the a

QA Advanced Unit Specification

General information

Unit title: Energy Technologies

Unit code: HT1L 48

Superclass: QB

Publication date: August 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

The Unit is designed to enable learners to develop knowledge and understanding in a range of technologies related to energy production on an industrial scale. Traditional, renewable and emerging and/or less common technologies will be considered in relation to key components, principles of operation, operational aspects and environmental and sustainability factors as appropriate.

The Unit is optional for learners in Engineering-related SQA Advanced Awards. It could also

be used as a stand-alone Unit where appropriate.

Outcomes

On successful completion of the Unit the learner will be able to:

1 Analyse the technologies and factors associated with traditional methods of energy production.

2 Analyse the technologies and factors associated with renewable methods of energy production.

3 Describe the technologies and factors associated with emerging and/or less common sustainable methods of energy production.

Credit points and level

1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8).

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 2

Recommended entry to the Unit

While entry is at the discretion of the centre, learners would normally be expected to have attained the entry requirements specific to the SQA Advanced Certificate/Diploma award.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering

alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 3

SQA Advanced Unit Specification: Statement of standards

Unit title: Energy Technologies

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment.

Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Analyse the technologies and factors associated with traditional methods of energy production.

Knowledge and/or Skills

¨ Components, principles of operation, operational aspects, energy produced and environmental and sustainability factors associated with:

— coal based technologies

— gas based technologies

— oil based technologies

— nuclear based technologies

Outcome 2

Analyse the technologies and factors associated with renewable methods of energy production.

Knowledge and/or Skills

¨ Components, principles of operation, operational aspects, energy produced and environmental and sustainability factors associated with:

— onshore wind turbines

— offshore wind turbines

— catchment based hydroelectric schemes

— pumped storage based hydroelectric schemes

— solar photovoltaic based technologies

— solar thermal based technologies

— biomass based technologies

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 4

Outcome 3

Describe the technologies and factors associated with emerging and/or less common sustainable methods of energy production.

Knowledge and/or Skills

¨ Components, principles of operation, operational aspects and environmental and sustainability factors associated with:

— tidal based schemes

— wave based schemes

— geothermal based schemes

— waste based technologies

Evidence Requirements for this Unit

Outcome 1

Evidence for the Knowledge and/or Skills in this Outcome will be generated through sampling. Each learner will need to provide evidence to demonstrate they can analyse two of the four technologies and factors associated with traditional methods of energy production. The evidence should be responses to specific questions.

To ensure that learners will not be able to foresee all the items they will be questioned about, a different sample should be used on successive assessment occasions. The new sample may contain a maximum of one of the Knowledge and/or Skills used in the previous assessment occasion.

A learner's response can be judged to be satisfactory where the evidence shows that the learner can:

¨ Describe the key components of the chosen technology.

¨ Explain the principles of operation of the chosen technology.

¨ Explain the operational aspects of the chosen technology.

¨ Describe the environmental and sustainability factors of the chosen technology.

¨ Determine the energy produced using supplied data for the chosen technology.

Evidence should be generated through a closed-book assessment under supervised conditions.

Outcome 2

Evidence for the Knowledge and/or Skills in this Outcome will be generated through sampling. Each learner will need to provide evidence to demonstrate they can analyse three of the seven technologies and factors associated with renewable methods of energy production. Each sample should consist of one wind and one hydro technology plus one from either solar or biomass. The evidence should be responses to specific questions.

To ensure that learners will not be able to foresee all the items they will be questioned about, successive assessment occasions should contain a different sample. As before, the requirement for one wind and one hydro to be included is valid although the choice of which wind (onshore or offshore) and which hydro (catchment or pumped storage) may be changed. The same solar technology cannot be used on the next assessment occasion. If

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 5

biomass technology was used in the assessment occasion then one of the solar technologies

must be used on the next assessment occasion

A learner's response can be judged to be satisfactory where the evidence shows that the learner can:

¨ Describe the key components of the chosen technology.

¨ Explain the principles of operation of the chosen technology.

¨ Explain the operational aspects of the chosen technology.

¨ Describe the environmental and sustainability factors of the chosen technology.

¨ Determine the energy produced using supplied data for the chosen technology.

Evidence should be generated through a closed-book assessment under supervised conditions.

Outcome 3

Evidence for the Knowledge and/or Skills in this Outcome will be generated through sampling. Each learner will need to provide evidence to demonstrate they can describe two of the four technologies and factors associated with emerging and/or less common sustainable methods of energy production. The evidence should be responses to specific questions.

To ensure that learners will not be able to foresee all the items they will be questioned about, a different sample of technologies should be used on successive assessment occasions. The new sample may contain a maximum of one of the technologies used in the previous assessment occasion.

A learner's response can be judged to be satisfactory where the evidence shows that the learner can:

¨ Describe the key components of the chosen technology.

¨ Explain the principles of operation of the chosen technology.

¨ Explain the operational aspects of the chosen technology.

¨ Describe the environmental and sustainability factors of the chosen technology.

Evidence should be generated through a closed-book assessment under supervised

conditions.

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 6

SQA Advanced Unit Specification:Support notes

Unit title: Energy Technologies

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is designed to introduce some of the current and emerging or less common technologies used in energy production. Traditional methods (coal, oil, gas and nuclear) and renewable methods (wind, solar, hydro and biomass) will be described in terms of principle of operation, system components, operational aspects and environmental and sustainability factors. Emerging and less common technologies (tidal, wave, geothermal and waste) will be described in terms of principle of operation, system components, operational aspects and environmental and sustainability factors.

Outcome 1

It is suggested that the following technologies be used in the delivery of this Outcome:

Coal: Pulverised coal combustion (PCC)

Gas: Combined cycle gas turbine (CCGT)

Oil: Crude oil combined cycle

Nuclear: Pressurised water reactors (PWR)

For each of the four technologies, diagrams should be used showing the key components in the energy conversion process from input through to output. Each stage in the process should be explained in terms of its function/operation. Operational aspects should include typical overall plant efficiencies, start-up time, utilisation for base or peak loads, reliability of supply and CO2 emissions per Unit of energy generated (gCO2/kWh). Environmental and

sustainability factors and the significance of each will vary depending on the technology but would typically include several of the following:

¨ Use of finite fossil fuels

¨ CO_2 released into atmosphere

¨ Visual amenity and noise impacts

¨ Air, land and water pollution

¨ Impact on wildlife and ecological systems

¨ Health and safety

¨ Waste products

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 7

Outcome 2

For each of the technologies, diagrams should be used showing the key components in the energy conversion process from input through to output. Each stage in the process should be explained in terms of its function/operation. Operational aspects should include typical overall plant (or Unit) efficiency, weather constraints, logistics (for offshore wind), reliability of supply and CO_2 emissions per Unit of energy generated (gCO_2/kWh). Environmental and sustainability factors and the significance of each will vary depending on the technology but would typically include several of the following:

¨ Use of renewable resources

¨ CO_2 released into atmosphere

¨ Visual amenity and noise impacts

¨ Air, land and water pollution

¨ Land-loss (large hydro schemes in particular)

¨ Impact on wildlife, marine life and ecological systems

¨ Waste products

Outcome 3

Marine (wave and tidal) technologies are expected to contribute to the future energy ‘mix’. At present, worldwide there are only a few operational marine power plants. Technologies to harness energy from the tide include tidal barrage and tidal stream. The European Marine Energy Centre (EMEC) in Orkney is one of the world’s leading marine technology research and testing centres and a useful source of information. Currently, there are several types of wave energy technologies at various stages of development. In the UK, examples include the ‘Pelamis’ attenuator system, the ‘Limpet’ oscillating water column system and the ‘Oyster’ oscillating wave surge convertor system. Energy production from geothermal sources utilises three main technologies and currently the US is the largest producer of geothermal energy. Historically, energy from waste has been via incineration however more recent technologies such as gasification and pyrolysis are now being commissioned. It is suggested that the following technologies be used in the delivery of this Outcome:

Tidal: Tidal barrage and Tidal stream

Wave: Attenuator systems, Oscillating water column systems and Oscillating wave surge convertor systems

Geothermal: Dry steam, Flash steam and Binary cycle

Waste: Incineration and Advanced Thermal Treatments (Gasification and Pyrolysis)

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 8

For each of the technologies, diagrams should be used showing the key components in the energy conversion process from input through to output. Each stage in the process should be explained in terms of its function/operation. Operational aspects should include typical overall plant (or Unit) efficiency (where data is available), logistics (for waste), reliability of supply and CO2 emissions per Unit of energy generated (gCO2/kWh). Environmental and sustainability factors and the significance of each will vary depending on the technology but would typically include several of the following:

¨ Use of renewable/sustainable resources

¨ CO_2 released into atmosphere

¨ Visual amenity and noise impacts

¨ Air, land and water pollution

¨ Impact on wildlife, marine life and ecological systems (tidal barrage in particular)

¨ Waste products

Guidance on approaches to delivery of this Unit

This Unit should be delivered in year 2 of an SQA Advanced Diploma programme. It would be beneficial if learners had previously completed the level 7 Unit Energy Overview. It is unlikely that it could be delivered through integration with other Units.

It would be beneficial if learners had classroom internet access. It is suggested that an equal amount of time be allocated to each Outcome.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

All Outcomes should be assessed on a sample basis.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

The Unit may be assessed on an Outcome by Outcome basis or through a combination of Outcomes.

Outcome 1

This Outcome may be assessed individually or in combination with Outcomes 2 and/or 3.

Evidence should be generated through a closed-book assessment under supervised conditions.

Outcome 2

This Outcome may be assessed individually or in combination with Outcomes 1 and/or 3.

Evidence should be generated through a closed-book assessment under supervised conditions.

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 9

Outcome 3

This Outcome may be assessed individually or in combination with Outcomes 1 and/or 2.

Evidence should be generated through a closed-book assessment under supervised conditions.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

Some Core Skills may be developed through the delivery of this Unit.

Information and Communications Technology (ICT) may be developed in all Unit Outcomes and in particular, the use of the internet to search for flowcharts, block diagrams and animations associated with each of the technologies.

Numeracy may be developed in Outcomes 1 and 2 in relation to the determination of energy output.

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 10

History of changes to Unit

Version Description of change Date

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification

HT1L 48, Energy Technologies (SCQF level 8) 11

General information for learners

Unit title: Energy Technologies

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

The Unit is designed to introduce a range of technologies associated with energy production. The technologies will be classified as traditional, renewable, and emerging and less common sustainable methods, for the purposes of this Unit. Traditional (existing) methods are based upon fossil fuel technologies and nuclear. Renewable methods are based upon the utilisation of non-fossil fuel based technologies. Emerging and less common sustainable methods are based upon technologies that are currently at various stages of development, implementation or operation together with technologies that are operational but are, overall, small energy producers relative to traditional and renewable methods.

The Unit is optional for learners on related SQA Advanced Engineering Awards. It could also be used as a stand-alone Unit where appropriate. No prior knowledge is required although it would be beneficial if learners have previously completed the level 7 Unit Energy Overview

and were familiar with using the internet for research purposes.

Outcome 1 has been designed to introduce traditional methods of energy production using coal, gas, oil and nuclear fuel sources. Typical power plant operation and processes will be explained detailing energy input through to energy output. Operational aspects, environmental and sustainability issues and numerical calculations pertaining to each technology will also be considered.

Outcome 2 has been designed to introduce renewable methods of energy production using wind, hydro, solar and biomass technologies. Typical power plant or device operation and processes will be explained detailing energy input through to energy output. Operational aspects, environmental and sustainability issues and numerical calculations pertaining to each technology will also be considered.

Outcome 3 has been designed to introduce emerging and/or less common sustainable methods of energy production. Tidal, wave, geothermal and waste technologies will be considered. Typical power plant or device operation and processes will be explained detailing energy input through to energy output. Operational aspects and environmental and sustainability issues pertaining to each technology will also be considered.

In order to achieve this Unit, all Outcomes must be achieved. This Unit will be assessed by responses to structured questions under closed-book conditions.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

The Unit has been designed to support articulation routes to degree programmes and also to support employment opportunities in the energy sector.SQA Advanced Unit Specification

General information for centres

Unit title: Engineering Mathematics 1 (SCQF level 6)

Unit code: HP48 46

Superclass: RB

Publication date: August 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to develop or consolidate a basic level of mathematical skills required of learners across a range of Engineering disciplines. The Unit provides learners with opportunities to develop knowledge, understanding and skills to solve mathematical problems including polynomial, trigonometrical, exponential and logarithmic functions. Learners will also be introduced to 3-dimensional vectors and complex numbers.

Outcomes

On successful completion of the Unit the learner will be able to:

1 Solve problems involving functions and trigonometric equations.

2 Solve problems involving exponential and logarithmic equations.

3 Apply mathematical techniques involving vectors and complex numbers.

Credit points and level

1 SQA Credit at SCQF level 6: (8 SCQF credit points at SCQF level 6)

Recommended entry to the Unit

Entry requirements are at the discretion of the centre. However, it would be advantageous if learners had good algebraic skills together with an ability to transpose engineering formulae and solve simple trigonometric equations. This knowledge and understanding may be

SQA Advanced Unit Specification

HP48 46 Engineering Mathematics 1 (SCQF level 6) 2

evidenced by possession of the NQ Unit Mathematics: Technician 1 or a pass at National 5 in Mathematics.

Core Skills

Achievement OF this Unit gives automatic certification of the following Core Skills component:

Complete Core Skill None

Core Skill component Using Number at SCQF level 6

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes for this Unit specification.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (http://www.sqa.org.uk/sqa/46233.2769.html).

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

HP48 46 Engineering Mathematics 1 (SCQF level 6) 3

Unit specification: statement of standards

Unit title: Engineering Mathematics 1 (SCQF level 6)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment.

Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Solve problems involving functions and trigonometric equations.

Knowledge and/or Skills

¨ Properties of functions

¨ Inverse functions

¨ Composite Functions

¨ Trigonometric equations

Outcome 2

Solve problems involving exponential and logarithmic equations.

Knowledge and/or Skills

¨ Evaluation of logarithmic and exponential expressions

¨ Transposition from logarithmic to exponential form and vice versa

¨ Laws of logarithms

¨ Graphics of logarithmic and exponential functions

Outcome 3

Apply mathematical techniques involving vectors and complex numbers.

Knowledge and/or Skills

¨ Collinearity

¨ Addition, subtraction and scalar multiplication of vectors

¨ Scalar product

¨ Conversion of complex numbers between rectangular and polar form

¨ Addition and subtraction of complex numbers

¨ Multiplication and division of complex numbers

¨ Representation of complex numbers on an Argand Diagram

SQA Advanced Unit Specification

HP48 46 Engineering Mathematics 1 (SCQF level 6) 4

Evidence Requirements for this Unit

A sampling approach will be used in the assessment of the Knowledge and/or Skills in this

Unit. Learners will need to provide written and/or recorded oral evidence to demonstrate their

Knowledge and/or Skills across all Outcomes by showing they can:

Outcome 1

Provide evidence of the following Knowledge and/or Skills each time this Outcome is

assessed:

¨ Solve two problems (one in degrees and one in radians) involving expressions of the

formsin( )A nx a b± = orcos( )A nx a b± =

Provide evidence of two out of three Knowledge and/or Skills remaining in this Outcome.

The following evidence should be provided for the particular Knowledge and/or Skill items

sampled:

¨ Identify the domain, range and asymptotes of a given function

¨ Solve one problem involving an inverse function

¨ Solve one problem involving a composite function

Outcome 2

Provide evidence of the following Knowledge and/or Skills each time this Outcome is

assessed.

Solve three problems to cover the Knowledge and/or Skills as follows, combining them where

appropriate:

¨ Evaluate formulae; one must include exponentials and one must include logarithms

¨ Transpose expressions from exponential form to logarithmic form and vice versa

¨ Use two out of the three laws of logarithms:

—log log logx y xy+ =

—log log log x

x y y

- =

—log log p

p x x=

¨ Sketch or identify a graph of either a logarithmic function (of the formy A In x= or10logy A x=

) or an exponential function (of the formx

Ae or.10x

A)

Fractional and negative coefficients and indices should be included.

Outcome 3

Provide evidence of five out of seven Knowledge and/or Skills in this Outcome. The following evidence should be provided for the particular Knowledge and/or Skill items sampled:

¨ Verify that three, 3-dimensional coordinates (A,B,C) are collinear and determine the ratio of AB to BC

¨ Solve two vector problems involving a combination of at least two of the following: addition of vectors; subtraction of vectors and multiplication of a vector by a scalar

SQA Advanced Unit Specification

HP48 46 Engineering Mathematics 1 (SCQF level 6) 5

¨ Calculate the angle between two 3-dimensional vectors using the scalar product

¨ Convert one vector (2-dimensional cases) or complex number in Cartesian form to polar form and one vector or complex number in polar form to Cartesian form showing clearly all working

¨ Solve one problem involving the addition and subtract of complex numbers (in rectangular form)

¨ Solve one problem involving the multiplication of two complex numbers (in rectangular form) and one problem involving the division of two complex numbers (in polar form)

¨ Represent accurately complex numbers in all four quadrants of an Argand Diagram

It is recommended that the assessment for all three Outcomes takes places at a single end

of Unit assessment event. Outcomes may also be assessed individually. All re-assessments should be based on a different assessment instrument. This should re-assess all three Outcomes or a full individual Outcome reflecting the format of the original assessment.

All re-assessments should be based on a different sample of Knowledge and/or Skills.

All assessments should be unseen, closed-book and carried out under supervised, controlled conditions.

Computer algebra must not be used in the assessment of this Unit.

SQA Advanced Unit Specification

HP48 46 Engineering Mathematics 1 (SCQF level 6) 6

Unit specification: support notes

Unit title: Engineering Mathematics 1 (SCQF level 6)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is one of a suite of five Units in Mathematics developed for SQA Advanced Qualifications across a range of engineering disciplines. The five Units are:

Engineering Mathematics 1

Engineering Mathematics 2

Engineering Mathematics 3

Engineering Mathematics 4

Engineering Mathematics 5

In the development of this Unit a list of topics expected to be covered by lecturers has been identified. Recommendations have also been made on how much time lecturers should spend on each Outcome. The use of this list of topics is strongly recommended to ensure continuity of teaching and learning and adequate preparation for the assessment of the Unit. Consideration of this list of topics alongside the Assessment Support Pack developed for this

Unit will provide clear indication of the standard expected in this Unit.

Outcome 1 (10 hours)

Solve problems involving functions and trigonometric equations

¨ Introduce the concept of the function (this may be done in terms of set theory and, in particular, a function or mapping as a rule which relates each element in one set to one and only one element in another set)

¨ List typical functions that occur in Engineering

¨ Introduce typical mathematical notation used with functions (eg( )f x ,єx R , (or, , ,N W Z Q etc.)

¨ Explain what is meant by an independent and dependent variable

¨ Define the terms domain and range of a function

¨ Introduce the concept of a pole (s) in a function and explain the impact of a pole (s) on the domain of a function which has one or more poles

¨ Demonstrate the way in which to determine the range and domains of functions

¨ Define the term asymptotes

¨ Demonstrate the way in which to determine the asymptotes to functions

¨ Introduce the idea of an inverse function1 ( )f x

¨ Determine the inverse functions of a range of functions

¨ Graph functions and their inverse functions

¨ Introduce composite functions (again this may be done in terms of set theory)

¨ Derive and evaluate a number of composite functions

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¨ Introduce the concept of the radian

Convert degrees to radians and vice versa (egrad π

180

q

= ´)

¨ Determine the solutions of equations of the formsin( )A nx B

a+ = ± orcos( )A nx B

a+ = ±

Outcome 2 (8 hours)

Transpose and solve exponential and logarithmic equations

¨ Introduce the exponential functionx

y a=

¨ Plot graphs of this function for different values ofa

¨ Plot a graph ofx

y a-

= to demonstrate that this produces the image ofx

y a=

¨ Explain thatlogax = y is the inverse function ofx

y a=

¨ Examine10x

y = and10logx y= as an important example of exponential and

logarithmic functions

¨ Plot10x

y = and10logx y= for a specified domain

¨ Examinex

y e= andlogex y= as a further important example of exponential and

logarithmic functions especially in the context of Engineering

¨ Plotx

y e= andlogex y= for a specified domain

¨ Evaluate expressions that include1010 ,log ,x x

y e and10log y

¨ Introduce the three laws of logarithms

¨ Solve problems involving the three laws of logarithms

¨ Transpose and evaluate expressions from Engineering which include the termkt

Ae orkt

Ae-

¨ Solve exponential equations3 5

(5 95, 0 1)x x ×

= = ×

¨ Solve logarithmic equations (eg10 10log (2) log (4) 0 5x x+ + + = × ;log (3) log (3) log 6e e et
t- - + =

)

Outcome 3 (14 hours)

Apply mathematical techniques to vectors and complex numbers

2-d and 3-d Vectors

¨ Introduce the concept of a vector and scalar and give examples of each form from

Engineering

¨ Outline notation commonly used with vectors

¨ Demonstrate the way in which to add and subtract 2-dimensional vectors graphically

¨ Introduce 2-dimensional vectors in component form

¨ Add and subtract vectors using their component form

¨ Multiply 2-dimensional vectors by a scalar

¨ Calculate the magnitude of 2-dimensional vectors using the equation2

12

2

12)()(yyxxd -+-=

SQA Advanced Unit Specification

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¨ Introduce 3-dimension coordinates and the representation of 3-dimensional vectors in component form

¨ Calculate the magnitude of 3-dimensional vectors using the equation2

12

2

12

2

12)()()(zzyyxxd -+-+-=

¨ Apply the concept of collinearity to 2- and 3- dimensional vectors

¨ Introduce the scalar product for 2-d and 3-d vectors

¨ Identify the properties of the scalar product (eg. .a b b a= ,.( ) . .a b c a b a c+ = + etc)

¨ Demonstrate the way in which the scalar product can be used to find the angle between two vectors

Complex Numbers

¨ Introduce complex numbers (different approaches may be taken to this, for example what happens when the determinant2 4 0b ac- < , or1i = - etc.)

¨ Identify normal notation used with complex numbers (engineers tend to usej while mathematicians usei)

¨ Introduce the Argand Diagram

¨ Demonstrate the representation of complex numbers in Cartesian and polar form (noting the domain of principal argument,arg( )z)

¨ Demonstrate the way in which to convert between Cartesian and polar form and vice versa

¨ Add and subtract complex numbers

¨ Multiply complex numbers in both Cartesian and polar form

¨ Introduce the complex conjugate

¨ Divide complex numbers in both Cartesian and polar form

¨ Represent complex numbers in all four quadrants of an Argand Diagram

Guidance on approaches to delivery of this Unit

This Unit provides core mathematical principles and processes which underpin much of the studies undertaken in a number of SQA Advanced Qualifications across a range of engineering disciplines. It is recommended that the Unit be delivered towards the beginning of these awards.

Centres may deliver the Outcomes in any order they wish, it is recommended that Outcome 1 is delivered first followed by Outcomes 2 and then Outcome 3.

It is recommended that Unit delivery is principally undertaken using a didactic approach. All teaching input should be supplemented by a significant level of formative assessment in which learners are provided with opportunities to develop their knowledge, understanding and skills of the mathematical topics covered in the Unit. Computer software and computer algebra may be used to support learning (eg to confirm the solutions of mathematical problems), but it is strongly recommended that such learning resources are only used in a supportive capacity and not as the principal means of delivering Unit content.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment.

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A recommended approach is the use of an examination question paper. The question paper should be composed of an appropriate balance of short answer, restricted response and structured questions.

All assessment papers should be unseen by learners prior to the assessment event and at all times, the security, integrity and confidentiality of assessment papers must be ensured.

Assessment should be conducted under closed-book, controlled and invigilated conditions.

The questions in the examination should not be grouped by Outcome or be labelled in terms of the Outcomes they relate to when a single end-of-Unit examination is used.

The summative assessment of all three Outcomes — whether individually or at a single assessment event — should not exceed two hours. When assessing a learner's responses to summative assessment lecturers should concentrate principally on the candidate's ability to apply the correct mathematical technique and processes when solving problems. Candidates should not be penalised for making simple numerical errors. An appropriate threshold score may be set for the assessment of this Unit. A threshold score should be used for each assessment if Outcome level assessment is used.

Learners should be provided with a formulae sheet appropriate to the content of this Unit when undertaking their assessment. Computer algebra should not be used in the assessment of this Unit.

It is the learner's responsibility to ensure that any calculator they use during assessment are not designed or adapted to offer any of the following facilities:

¨ language translators

¨ symbolic algebra manipulation

¨ complex number manipulation

¨ communication with other machines or the internet.

In addition, any calculator used by learners should have no retrievable information stored in them. This includes:

¨ data banks

¨ dictionaries

¨ mathematical formulae

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we

mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

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Opportunities for developing Core and other essential skills

This Unit has the Using Number component of Numeracy embedded in it. This means that when candidates achieve the Unit, their Core Skills profile will also be updated to show that they have achieved Using Number at SCQF level 6.

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Administrative information

Version Description of change Date

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SQA Advanced Unit Specification

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General information for candidates

Unit title: Engineering Mathematics 1 (SCQF level 6)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

The Engineering Mathematics 1 Unit is one of a suite of five Units in Mathematics developed for SQA Advanced Certificates and Diplomas across a range of Engineering disciplines. The five Units help develop the mathematical skills required for workplace roles and for more advanced studies in Engineering, for example, articulation to degree study at university.

The Unit is mandatory in a number of SQA Advanced Certificates in Engineering.

This Unit is designed to develop or consolidate a basic level of mathematical skills required of learners across a range of Engineering disciplines. You will learn about the properties of some mathematical functions commonly used in Engineering including linear, trigonometrical, exponential and logarithmic functions. You will also learn how to solve trigonometrical, exponential and logarithmic equations. You will also study 2 and 3-dimensional vectors and complex numbers which are widely used in mechanical and electrical Engineering.

It is likely that Unit delivery will comprise of a significant teaching input from your lecturer. This will be supplemented by tutorial exercises which will allow you to develop the knowledge, understanding and skills to apSQA Advanced Unit Specification

General information for centres

Unit title: Engineering Mathematics 2 (SCQF level 7)

Unit code: HP49 47

Superclass: RB

Publication date: August 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to develop the necessary mathematical skills required of learners seeking to use an SQA Advanced Diploma in Engineering as an exit qualification for an Engineering workplace role or as a pathway to further studies in mathematics at an advanced level. The Unit provides learners with opportunities to develop knowledge, understanding and skills to solve problems involving trigonometric and hyperbolic functions and identities; to differentiate and integrate a wide range of functions and use differentiation and integration techniques to solve Engineering problems.

Outcomes

On successful completion of the Unit the learner will be able to:

1 Solve trigonometric and hyperbolic function problems.

2 Use differentiation techniques to solve Engineering problems.

3 Use integration techniques to solve Engineering problems.

Credit points and level

1 SQA Unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

Entry requirements are at the discretion of the centre. However, it would be advantageous if learners had a knowledge and understanding of functions including trigonometrical, log and

SQA Advanced Unit Specification

HP49 47 Engineering Mathematics 2 (SCQF level 7) 2

exponential functions together with sound algebraic skills. This knowledge and understanding may be evidenced by possession of the SQA Advanced Unit Engineering Mathematics 1 or Higher Mathematics.

Core Skills

Achievement OF this Unit gives automatic certification of the following Core Skills component:

Complete Core Skill None

Core Skill component Using Number at SCQF level 6

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes for this Unit specification.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (http://www.sqa.org.uk/sqa/46233.2769.html).

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

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Unit specification: statement of standards

Unit title: Engineering Mathematics 2 (SCQF level 7)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment.

Learners should not know in advance the items on which they will be assessed and different

items should be sampled on each assessment occasion.

Outcome 1

Solve trigonometric and hyperbolic function problems.

Knowledge and/or Skills

¨ Inverse trigonometric ratios

¨ Compound angle formulae

¨ Basic trigonometric identities

¨ Hyperbolic functions

¨ Basic hyperbolic identities

Outcome 2

Use differentiation techniques to solve Engineering problems.

Knowledge and/or Skills

¨ Differentiation of standards functions

¨ Chain Rule

¨ Second derivatives

¨ Rates of change

¨ Optimisation

Outcome 3

Use integration techniques to solve Engineering problems.

Knowledge and/or Skills

¨ Indefinite and definite integrals

¨ Integration of standard functions

¨ Applications of integration

Evidence Requirements for this Unit

A sampling approach will be used in the assessment of the Knowledge and/or Skills in this

Unit. Learners will need to provide written and/or recorded oral evidence to demonstrate their

Knowledge and/or Skills across all Outcomes by showing that they can:

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Outcome 1

Provide evidence of three out of the five Knowledge and/or Skills in this Outcome. The following evidence should be provided for the particular Knowledge and/or Skill items sampled:

¨ Evaluate any two of the following trigonometric functions:sec cosec cot

a a a, , or for a

given value (s) ofa

¨ Solve one problem using one of the following compound angle formulaesin( )x

b± orcos( )x

b±

¨ Solve one problem using one or more of the following trigonometric identitiescos cos –

cos cos – sin

sin cos

sin sin cos

a a

a a a

a

a

a

a a

+ =

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2

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2 2

2 2 1

2

2 2

1

¨ Evaluate any two of the following hyperbolic functions:sinh cosh tanh

a a

a, or for a

given value (s) ofa

¨ Solve one problem involving hyperbolic identities

Outcome 2

Provide evidence of three out of the five Knowledge and/or Skills in this Outcome. The following evidence should be provided for the particular Knowledge and/or Skill items sampled:

¨ Use standard derivatives to solve two problems involving differentiation (standard derivatives to include( )n n

ax ax b+, , trigonometric, hyperbolic,ln( )ax b+ and( )

e ax b+)

¨ Differentiate a function which requires the use of the chain rule

¨ Apply first and second derivatives to determine the position and nature of a turning point on a curve

¨ Use differentiation to determine the rate of change of a variable in an Engineering problem

¨ Apply differentiation techniques to find the optimum solution to a problem

Outcome 3

Provide evidence of two out of the three Knowledge and/or Skills in this Outcome. The following evidence should be provided for the particular Knowledge and/or Skill items sampled:

¨ Solve one indefinite and one definite integral

¨ Solve two integrals using integrals of standard functions (standard functions to include( )n n

ax ax b+,

, trigonometric, hyperbolic,ln( )ax b+ and( )

e ax b+)

¨ Apply integration techniques to the solution of an Engineering problem

It is recommended that the assessment for all three Outcomes takes places at a single end of Unit assessment event. Outcomes may also be assessed individually. All re-assessments

SQA Advanced Unit Specification

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should be based on a different assessment instrument. This should re-assess all three Outcomes or a full individual Outcome reflecting the format of the original assessment. All re-assessments should be based on a different sample of Knowledge and/or Skills.

All assessments should be unseen, closed-book and carried out under supervised, controlled conditions.

Computer algebra must not be used in the assessment of this Unit.

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Unit specification: support notes

Unit title: Engineering Mathematics 2 (SCQF level 7)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is one of a suite of five Units in Mathematics developed for SQA Advanced Qualifications across a range of Engineering disciplines. The five Units are:

Engineering Mathematics 1

Engineering Mathematics 2

Engineering Mathematics 3

Engineering Mathematics 4

Engineering Mathematics 5

In the development of this Unit a list of topics expected to be covered by lecturers has been identified. Recommendations have also been made on how much time lecturers should spend on each Outcome. The use of this list of topics is strongly recommended to ensure continuity of teaching and learning and adequate preparation for the assessment of the Unit. Consideration of this list of topics alongside the Assessment Support Pack developed for this Unit will provide clear indication of the standard expected in this Unit.

Outcome 1 (12 hours)

Solve trigonometric and hyperbolic function problems

¨ Definitions of secant, cosecant and cotangent ratios

¨ Evaluation of secant, cosecant and cotangent ratios for given angles

¨ Distinguish between secant, cosecant and cotangent andcos sin tan- - -1 1 1

, and

¨ State compound angle formulae (egsin( ) sin cos sin cos

a b a b b a+ = ± and( )cos cos cos sin sin

a b a b a b± =

¨ Apply compound angle formulae to trigonometrical problems (eg( )sin sin

q

q+ = -180

¨ Statesin cos sin s cos cos –

sin cos cos –

in cos

sin

a

a a

a

a

a

a

a

a

a

a

+ = = =

- =

2

2 2 2

2 2 2 2 1 or

1

1

2

2 2 and

2 ,

,

¨ Use trigonometrical equations in previous bullet point to simplify trigonometrical identities and solve trigonometrical equations

¨ Define sinh x, cosh x, tanh x, cosech x, sech x and coth x

SQA Advanced Unit Specification

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¨ Use the following hyperbolic identities to prove identities and modify equations

containingex ande x- :( )

2 2

e cosh sinh

e cosh sinh

cosh – sinh

sinh sinh cosh cosh sinh

cosh cosh cosh sinh sinh

se differentiation techniques to solve Engineering problems

¨ Revise indices including negative and fractional indices

¨ Introduce the concept of differentiation from first principles (not assessable)

¨ Introduce standard derivatives to include( )n n

ax ax b+, , trigonometric, hyperbolic,ln( )ax b+

and( )

e ax b+

¨ Use standard derivatives to find the derivatives of functions containing one or more of

the terms in the previous bullet point

¨ State the chain rule, egdy dy du

dx du dx

= ´

¨ Apply the chain rule to functions such as (3x4 + 7)3; sin (t2 + 1); 5esinu etc.

¨ Define higher derivatives (ie second, third, etc)

¨ Use the first and second derivatives to find the maximum and minimum of a function

¨ Use differentiation to evaluate rates of change problems in Engineering

¨ Apply differentiation to optimise a parameter or parameters of a problem (eg the

condition under which the maximum electrical power will be transferred from a voltage source to load)

Outcome 3 (8 hours)

Use integration techniques to solve Engineering problems

¨ Define what is meant by integration (eg as anti-differentiation, as the area bounded by curves, etc

¨ Define indefinite and definite integrals

¨ Solve indefinite and definite integrals using standard integrals (standard integrals to include( )n n

ax ax b+, , trigonometric, hyperbolic,ln( )ax b+ and( )

e ax b+)

¨ Apply integration to solve problems in Engineering (area under a velocity time curve giving distance travelled, work done by an expanding gas, first and second moments of area, centroids, mean values, root mean square values, etc)

SQA Advanced Unit Specification

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Guidance on approaches to delivery of this Unit

This Unit provides core mathematical principles and processes which underpin much of the studies undertaken in a number of SQA Advanced Qualifications across a range of Engineering disciplines. It is recommended that the Unit be delivered towards the beginning of these awards.

Centres may deliver the Outcomes in any order they wish, it is recommended that Outcome 1 is delivered first followed by Outcomes 2 and then Outcome 3.

It is recommended that Unit delivery is principally undertaken using a didactic approach. All teaching input should be supplemented by a significant level of formative assessment in which learners are provided with opportunities to develop their knowledge, understanding and skills of the mathematical topics covered in the Unit. Computer software and computer

algebra may be used to support learning (egto confirm the solutions of mathematical problems), but it is strongly recommended that such learning resources are only used in a supportive capacity and not as the principal means of delivering Unit content.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment.

A recommended approach is the use of an examination question paper. The question paper should be composed of an appropriate balance of short answer, restricted response and structured questions.

All assessment papers should be unseen by learners prior to the assessment event and at all times, the security, integrity and confidentiality of assessment papers must be ensured.

Assessment should be conducted under closed-book, controlled and invigilated conditions.

The questions in the examination should not be grouped by Outcome or be labelled in terms of the Outcomes they relate to when a single end-of-Unit examination is used.

The summative assessment of all three Outcomes — whether individually or at a single assessment event - should not exceed two hours. When assessing a learner's responses to summative assessment lecturers should concentrate principally on the learner's ability to apply the correct mathematical technique and processes when solving problems. Learners should not be penalised for making simple numerical errors. An appropriate threshold score may be set for the assessment of this Unit. A threshold score should be used for each assessment if Outcome level assessment is used.

Learners should be provided with a formulae sheet appropriate to the content of this Unit when undertaking their assessment. Computer algebra should not be used in the assessment of this Unit.

It is the learners' responsibility to ensure that any calculator they use during assessment are not designed or adapted to offer any of the following facilities:

¨ language translators

¨ symbolic algebra manipulation

¨ symbolic differentiation or integration

¨ communication with other machines or the internet

SQA Advanced Unit Specification

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In addition, any calculator used by learners should have no retrievable information stored in them. This includes:

¨ databanks

¨ dictionaries

¨ mathematic formulae

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

This Unit has the Using Number component of Numeracy embedded in it. This means that when candidates achieve the Unit, their Core Skills profile will also be updated to show that they have achieved Using Number at SCQF level 6.

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HP49 47 Engineering Mathematics 2 (SCQF level 7) 10

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SQA Advanced Unit Specification

HP49 47 Engineering Mathematics 2 (SCQF level 7) 11

General information for candidates

Unit title: Engineering Mathematics 2 (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

The Engineering Mathematics 2 Unit is one of a suite of five Units in Mathematics developed for SQA Advanced Certificates and Diplomas across a range of Engineering disciplines. The five Units help develop the mathematical skills required for workplace roles and for more advanced studies in Engineering, for example, articulation to degree study at university.

The Unit is mandatory in a number of SQA Advanced Diplomas in Engineering.

This Unit is designed to develop the necessary mathematical skills required of learners seeking to use an SQA Advanced Diploma in Engineering as an exit qualification for an Engineering workplace role or as a pathway to further studies in mathematics at an advanced level. You will be introduced to differential calculus which is used widely to solve

Engineering problems. This will include differentiating functions using standard derivatives, determining rates of change and finding optimum solutions to Engineering problems. You will also be introduced to integral calculus which is in many ways the reverse process of differentiation. You will learn to solve indefinite and definite integrals using standard integrals and use integration to solve Engineering problems.

It is likely that Unit delivery will comprise of a significant teaching input from your lecturer. This will be supplemented by tutorial exercises which will allow you to develop the knowledge, understanding and skills to apply the mathematic principles and processes covered in the Unit to a range of Engineering problems.

Depending on which centre you attend, formal assessment may be conducted on an Outcome by Outcome basis or by one holistic assessment. Assessment will be conducted under closed-book, controlled and invigilated conditions.

Learners considering taking this Unit will normally be expected to have passed the Engineering Mathematics 1 SQA Advanced Unit or equivalent.ply the mathematic principles and processes

covered in the Unit to a range of Engineering problems.

Depending on which centre you attend, formal assessment may be conducted on an

se differentiation techniques to solve Engineering problems

¨ Revise indices including negative and fractional indices

¨ Introduce the concept of differentiation from first principles (not assessable)

¨ Introduce standard derivatives to include( )n n

ax ax b+, , trigonometric, hyperbolic,ln( )ax b+

and( )

e ax b+

¨ Use standard derivatives to find the derivatives of functions containing one or more of the terms in the previous bullet point

¨ State the chain rule, egdy dy du

dx du dx

= ´

¨ Apply the chain rule to functions such as (3x4 + 7)3; sin (t2 + 1); 5esinu etc.

¨ Define higher derivatives (ie second, third, etc)

¨ Use the first and second derivatives to find the maximum and minimum of a function

¨ Use differentiation to evaluate rates of change problems in Engineering

¨ Apply differentiation to optimise a parameter or parameters of a problem (eg the condition under which the maximum electrical power will be transferred from a voltage source to load)

Outcome 3 (8 hours)

Use integration techniques to solve Engineering problems

¨ Define what is meant by integration (eg as anti-differentiation, as the area bounded by curves, etc

¨ Define indefinite and definite integrals

¨ Solve indefinite and definite integrals using standard integrals (standard integrals to include( )n n

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e ax b+)

¨ Apply integration to solve problems in Engineering (area under a velocity time curve giving distance travelled, work done by an expanding gas, first and second moments of area, centroids, mean values, root mean square values, etc)

SQA Advanced Unit Specification

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Guidance on approaches to delivery of this Unit

This Unit provides core mathematical principles and processes which underpin much of the studies undertaken in a number of SQA Advanced Qualifications across a range of

Engineering disciplines. It is recommended that the Unit be delivered towards the beginning of these awards.

Centres may deliver the Outcomes in any order they wish, it is recommended that Outcome 1 is delivered first followed by Outcomes 2 and then Outcome 3.

It is recommended that Unit delivery is principally undertaken using a didactic approach. All teaching input should be supplemented by a significant level of formative assessment in which learners are provided with opportunities to develop their knowledge, understanding and skills of the mathematical topics covered in the Unit. Computer software and computer algebra may be used to support learning (egto confirm the solutions of mathematical problems), but it is strongly recommended that such learning resources are only used in a supportive capacity and not as the principal means of delivering Unit content.

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assessment if Outcome level assessment is used.

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SQA Advanced Unit Specification

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Opportunities for e-assessment

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Opportunities for developing Core and other essential skills

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General information for candidates

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for SQA Advanced Certificates and Diplomas across a range of Engineering disciplines. The five Units help develop the mathematical skills required for workplace roles and for more advanced studies in Engineering, for example, articulation to degree study at university.

The Unit is mandatory in a number of SQA Advanced Diplomas in Engineering.

This Unit is designed to develop the necessary mathematical skills required of learners seeking to use an SQA Advanced Diploma in Engineering as an exit qualification for an Engineering workplace role or as a pathway to further studies in mathematics at an advanced level. You will be introduced to differential calculus which is used widely to solve Engineering problems. This will include differentiating functions using standard derivatives, determining rates of change and finding optimum solutions to Engineering problems. You will also be introduced to integral calculus which is in many ways the reverse process of differentiation. You will learn to solve indefinite and definite integrals using standard integrals and use integration to solve Engineering problems.

It is likely that Unit delivery will comprise of a significant teaching input from your lecturer. This will be supplemented by tutorial exercises which will allow you to develop the knowledge, understanding and skills to apply the mathematic principles and processes covered in the Unit to a range of Engineering problems.

Depending on which centre you attend, formal assessment may be conducted on an Outcome by Outcome basis or by one holistic assessment. Assessment will be conducted under closed-book, controlled and invigilated conditions.

Learners considering taking this Unit will normally be expected to have passed the Engineering Mathematics 1 SQA Advanced Unit or equivalent.ply the mathematic principles and processes

covered in the Unit to a range of Engineering problems.

Depending on which centre you attend, formal assessment may be conducted on an

Expand the product of two functions using series forms (eg ( ) ,e ln e tanx x

x x+1 etc.)

(learners could be provided with a table showing the series expansion of standard

functions such as ( ), , ,e sin cos nx x x x+1 etc)

¨ Develop a linear approximation of one polynomial or one non-linear function

(eg , ,sin cos e x

x x - etc)

Outcome 4 (12 hours)

Solve first order differential equations

¨ Introduction to differential equations — explain the meaning of dependent and independent variables, order of a differential equation, linearity, initial conditions, etc.

¨ Solve first order differential equations by direct integration

¨ Introduce the separation of variables method as applying to equations of the following form

( ) ( )

dy f x g y

dx =

¨ Apply the method of separation of variables to solve first order differential equations (including first order differential equations that arise in Engineering)

¨ Introduce the method of solving differential equations by substitution (eg using

y vx y ax by c= = + +or

¨ Apply the method of substitution to the solution of first order differential equations

¨ Introduce the integrating factor method as applying to first order differential equations of the following form:

( ) ( )

dy p x y q x

dx + =

where the integrating factor ( )

e p x dxò=

SQA Advanced Unit Specification

HT0348, Engineering Mathematics 4 (SCQF level 8) 9

¨ Apply the integrating factor method to the solution of first order differential equations

¨ Illustrate how some first order differential equations may be solved by more than one method

¨ Solve first order differential equations taken from Engineering with an initial value using one of the methods shown above

Guidance on approaches to delivery of this Unit

This Unit provides many of the core mathematical principles and processes required when studying Engineering at a more advanced level. Given the nature of the subject matter in the Unit it is advisable that the Unit is not delivered until learners have studied Engineering Mathematics 3.

Centres may deliver the Outcomes in any order they wish.

The Unit may be delivery using a didactic approach. All teaching input should be supplemented by a significant level of formative assessment in which learners are provided with opportunities to develop their knowledge, understanding and skills of the mathematical topics covered in the Unit. Alternatively, as learners taking this Unit may be preparing to enter an degree course at university (possibly at an advanced level) the Unit could be delivered as a series of lectures supported by tutorial sessions to help learners prepare better for future university studies.

Computer software and computer algebra may be used to support learning (eg to confirm the solutions of mathematical problems), but it is strongly recommended that such learning resources are only used in a supportive capacity and not as the principal means of delivering Unit content.

Guidance on approaches to assessment of this Unit

The recommended approach is the use of an examination question paper. The question

paper should be composed of an appropriate balance of short answer, restricted response and structured questions. The questions in the examination should not be grouped by Outcome or be labelled in terms of the Outcomes they relate to.

All assessment papers should be unseen by the learners prior to the assessment event and at all times, the security, integrity and confidentiality of assessment papers must be ensured.

Assessment should be conducted under closed-book, controlled and invigilated conditions.

The summative assessment of all four Outcomes should not exceed two hours. When assessing a learner's responses to summative assessment lecturers should concentrate principally on the learner's ability to apply the correct mathematical technique and processes when solving problems. Learners should not be penalised for making simple numerical errors. An appropriate threshold score may be set for the assessment of this Unit.

Learners should be provided with a formulae sheet appropriate to the content of this Unit when undertaking their assessment. Computer algebra should not be used in the assessment of this Unit.

SQA Advanced Unit Specification

HT0348, Engineering Mathematics 4 (SCQF level 8) 10

SQA Advanced Unit Specification: Support notes

Unit title: Engineering Mathematics 4 (SCQF level 8)

It is the learners' responsibility to ensure that any calculator they use during assessment are not designed or adapted to offer any of the following facilities:

¨ language translators

¨ symbolic algebra manipulation

¨ symbolic differentiation or integration

¨ communication with other machines or the internet

In addition, any calculator used by learners should have no retrievable information stored in them. This includes:

¨ databanks

¨ dictionaries

¨ mathematic formulae

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

This Unit has the Using Number component of Numeracy embedded in it. This means that when candidates achieve the Unit, their Core Skills profile will also be updated to show that they have achieved Using Number at SCQF level 6.

SQA Advanced Unit Specification

HT0348, Engineering Mathematics 4 (SCQF level 8) 11

History of changes to Unit

Version Description of change Date

02 Outcome 2 – Evidence requirements 2 – amended. 06/02/2020

acknowledged.

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification

HT0348, Engineering Mathematics 4 (SCQF level 8) 12

General information for learners

Unit title: Engineering Mathematics 4 (SCQF level 8)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

The Engineering Mathematics 4 Unit is one of a suite of five Units in Mathematics developed for SQA Advanced Certificates and Diplomas across a range of Engineering disciplines. The five Units help develop the mathematical skills required for workplace roles and for more advanced studies in Engineering, for example, articulation to degree study at university.

The Unit is optional in a number of SQA Advanced Diplomas in Engineering.

This Unit is designed to develop the mathematical skills required by learners who wish to use their SQA Advanced Diploma in Engineering to articulate to university degree study. You will learn about complex numbers (otherwise known as imaginary numbers) and the algebra that underpins the use of these numbers. Complex numbers arise in many branches of Engineering (eg ac electrical circuits). You will also learn to apply matrix techniques which are particularly useful when, for example, solving systems of linear equations containing several variables. You will develop the knowledge, understanding and skills to use Taylor's and MacLaurin's series to represent functions, and finally you will be introduced to a range of techniques for solving an important class of equations known as first order differential equations which arise extensively in many areas of Engineering.

Unit delivery may comprise of a significant teaching input from your lecturer supplemented by tutorial exercises which will allow you to develop the knowledge, understanding and skills to apply the mathematic principles and processes covered in the Unit to a range of Engineering problems. Alternatively, in order to prepare you for studies at university the centre where you are taking this Unit may choose to deliver it as a series of lectures supported by tutorials.

Formal assessment will be through an examination. Assessment will be conducted under closed-book, controlled and invigilated conditions.

Learners considering taking this Unit will normally be expected to have pasSQA Advanced Unit specification

General information

Unit title: Engineering Mathematics 5 (SCQF level 8)

Unit code: HT1N 48

Superclass: RB

Publication date: August 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to develop the mathematical skills required by learners who wish to use their SQA Advanced Diploma in Engineering to articulate to university degree study. The Unit will provide learners with the opportunities to develop knowledge, understanding and skills to solve second order, constant coefficient differential equations; use partial differentiation and double integration techniques to solve a range of mathematical problems, solve first and second order differential equations using Laplace Transforms and use eigenvalues and eigenvectors to solve linear system equations.

Outcomes

On successful completion of the Unit the learner will be able to:

1 Solve second order, constant coefficient differential equations.

2 Solve mathematical problems using partial differentiation.

3 Solve mathematical problems using double integration techniques.

4 Solve differential equations using Laplace Transforms.

5 Use eigenvalues and eigenvectors to solve linear system equations.

Credit points and level

1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8)

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 2

Recommended entry to the Unit

Entry requirements are at the discretion of the centre. However, it would be advantageous if learners had a good knowledge and understanding of differential and integral calculus which included techniques for solving first order differential equations; a sound knowledge and understanding of basic matrix techniques together with strong numerical and algebraic skills. This knowledge and understanding may be evidenced by possession of the SQA Advanced Units Engineering Mathematics 3 and Engineering Mathematics 4.

Core Skills

Achievement OF this Unit gives automatic certification of the following Core Skills component:

Complete Core Skill None

Core Skill component Using Number at SCQF level 6

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes for this Unit specification.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and

practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (http://www.sqa.org.uk/sqa/46233.2769.html).

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 3

SQA Advanced Unit Specification: Statement of standards

Unit title: Engineering Mathematics 5 (SCQF level 8)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment.

Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Solve second order, constant coefficient differential equations.

Knowledge and/or Skills

¨ Homogenous

¨ Non-Homogenous

¨ General solution of second order differential equations

¨ Linear Approximation Techniques

Outcome 2

Solve mathematical problems using partial differentiation.

Knowledge and/or Skills

¨ Partial Differentiation

¨ Chain/ Product/Quotient Rules

¨ Higher Order Partial Derivatives

¨ Stationary points

Outcome 3

Solve mathematical problems using double integration techniques.

Knowledge and/or Skills

¨ Rectangular Domain

¨ Polar Domain

¨ Change order of integration in double integrals

¨ Volumes or surface areas

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 4

Outcome 4

Solve differential equations using Laplace Transforms.

Knowledge and/or Skills

¨ Laplace Transforms

¨ Inverse Laplace Transforms

¨ Shift theorems

¨ Dirac Delta Function

¨ First and Second Order Differential Equations

Outcome 5

Use eigenvalues and eigenvectors to solve linear system equations.

Knowledge and/or Skills

¨ Eigenvalues and Eigenvectors

¨ Eigenvalue related problems

Evidence Requirements for this Unit

A sampling approach will be used in the assessment of the Knowledge and/or Skills in this

Unit. Learners will need to provide written and/or recorded oral evidence to demonstrate their

Knowledge and/or Skills across all Outcomes by showing they can:

Outcome 1

Provide evidence of three out of four Knowledge and/or Skills in this Outcome. The

following evidence should be provided for the particular Knowledge and/or Skill items

sampled:

¨ Determine the complimentary function of one second order differential equation

¨ Determine the particular integral of one second order differential equation

¨ Determine the particular solution of one second order, constant coefficient differential

equation given initial conditions

¨ Use a Taylor linear approximation and solve the resulting second order non-linear

differential equation

Outcome 2

Provide evidence of three out of four Knowledge and/or Skills in this Outcome. The

following evidence should be provided for the particular Knowledge and/or Skill items

sampled:

¨ Solve one mathematical problem involving first order partial derivatives

¨ Solve one partial differentiation problem involving the use of the chain, product or

quotient rules

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 5

¨ Solve one problem involving higher order partial differentiation

¨ Solve one problem which involves finding the location and nature of a stationary point (s) for a function of the form(,)f x y

Outcome 3

Provide evidence of three out of five Knowledge and/or Skills in this Outcome. The following evidence should be provided for the particular Knowledge and/or Skill items sampled:

¨ Define the domain and limits of integration

¨ Solve a double integral in the rectangular domain

¨ Solve a double integral after transforming the integrand to the polar domain

¨ Solve a double integral by changing the order in the double integration

¨ Use double integration to determine the volume or surface area of a shape or length of a curve

Outcome 4

Provide evidence of three out of five Knowledge and/or Skills in this Outcome. The following evidence should be provided for the particular Knowledge and/or Skill items sampled:

¨ Determine the Laplace Transform of a function( )f t from a table of Laplace Transforms

¨ Determine the inverse Laplace Transform of a function( )f s using the completing the square or partial fraction methods

¨ Solve one problem which involves the use of the first or second shift theorems

¨ Solve one problem which involves the use of the Dirac Delta function

¨ Solve a first or second order differential equation with initial conditions using Laplace Transforms

Outcome 5

Provide evidence of the following Knowledge and/or Skills each time this Outcome is assessed:

¨ Determine eigenvalue and eigenvector for one 3 × 3 matrix

¨ Determine a diagonalisation transform to solve a problem of An

The assessment of all five Outcomes should take place at a single end of Unit assessment

event. All re-assessments should be based on a different assessment instrument. This should re-assess all five Outcomes. All re-assessments should be based on a different sample of Knowledge and/or Skills.

All assessments should be unseen, closed-book and carried out under supervised, controlled conditions.

Computer algebra must not be used in the assessment of this Unit.

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 6

SQA Advanced Unit Specification:Support notes

Unit title: Engineering Mathematics 5 (SCQF level 8)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is one of a suite of five Units in Mathematics developed for SQA Advanced Qualifications across a range of engineering disciplines. The five Units are:

Engineering Mathematics 1

Engineering Mathematics 2

Engineering Mathematics 3

Engineering Mathematics 4

Engineering Mathematics 5

In the development of this Unit a list of topics expected to be covered by lecturers has been identified. Recommendations have also been made on how much time lecturers should spend on each Outcome. The use of this list of topics is strongly recommended to ensure continuity of teaching and learning and adequate preparation for the assessment of the Unit. Consideration of this list of topics alongside the Assessment Support Pack developed for this Unit will provide clear indication of the standard expected in this Unit.

Outcome 1 (6 hours)

Solve second order, constant coefficient differential equations.

¨ Introduce the general form of a constant coefficient, second order linear differential

equation as follows:( )

2

2

d y dy

a b cy f x

dx dx

+ + =

where a, b, c are constants

¨ Provide examples of second order differential equations from engineering

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 7

¨ Explain that solving a second order linear differential equation involves the following

three stages:

— Finding the complementary function, ycf

— Finding a particular integral, ypi

— Determining the general solution by adding together the complementary function

and the particular integral (y = ycf + ypi) and applying initial conditions where known

¨ Explain the difference between homogeneous and non-homogenous in the context of

second order differential equations

¨ Introduce the auxiliary equation (characteristic equation) and explain that when finding

roots of the auxiliary equation there are three cases we need to consider

¨ Explain that to find the complementary function one is finding the solution to the equation2

2 0

d y dy

a b cy

dx dx

+ + =

¨ Find the complementary functions of second order differential equations using solutions of the form y=ekx

¨ Explore the various forms a complementary function can take

¨ Explain that the particular integral is any function which satisfies the following equation( )

2

2

d y dy

a b cy f x

dx dx

+ + =

¨ Explain that for special classes of( )f x we can use the Method of Undetermined Coefficients to find the particular integral

¨ Find the general solution of second order differential equations including applying initial conditions

Outcome 2 (5 hours)

Solve mathematical problems using partial differentiation.

¨ Introduce partial differentiation as the process of differentiating functions of two or more variables

¨ Identify the notation used in partial differentiation

¨ For any function(,)f x y differentiate with respect to x treating all terms in y as constant

¨ For any function(,)f x y differentiate with respect to y treating all terms in x as constant

¨ Undertake partial differentiation involving the use of the chain, product or quotient rules

¨ Introduce higher order partial derivatives

¨ Demonstrate the way in which to determine higher order derivatives

¨ Introduce examples of partial differential equations (solutions not required) which occur in engineering

¨ Explain and demonstrate the way in which to find the location and nature of a stationary point for a function of the form(,)z f x y=

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 8

Outcome 3 (5 hours)

Solve mathematical problems using double integration techniques.

¨ Explain that double integration involves integrating a function(,)f x y as follows:( ),

R

dyf y dxxòò

where R is the region of integration in the x – y plane

¨ Explain that the process of double integration normally comprises the following three stages:

— Work out the limits of integration if these are not known

— Determine the inner integral assuming terms in x are constant

— Determine the outer integral

¨ Perform double integration where the limits are known and where they have to be determined

¨ Demonstrate that changing the order of integration can sometimes make double integration easier or possible to perform

¨ Demonstrate the way in which double integration may be performed by transforming variables from the rectangular domain to the polar domain

¨ Use double integration to determine the volume or surface areas of objects or the length of a curve

Outcome 4 (6 hours)

Solve differential equations using Laplace Transforms.

¨ Explain that the Laplace transform method is an integral transform method in which a linear constant coefficient differential equations is transformed into an algebraic equation. The corresponding algebraic equation is then solved and the transform reversed to find the solution of the differential equation.

¨ Introduce the Laplace Transform of( )f t as:( ) e ( )

0

st

F s f t dt

¥

-

= ò

(non-assessable)

¨ Determine one or two simple Laplace Transforms using the above equation

¨ Direct learners to tables of Laplace Transforms and Inverse Laplace Transforms

¨ Demonstrate techniques for finding the inverse of functions of( )F s using completing the square and partial fractions

¨ Introduce the first and second shift theorems

¨ Demonstrate the application of the two theorems

¨ Introduce the Dirac Delta function (simple treatment only) — provide engineering analogies (eg a power supply spike or a hammer striking an object)

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 9

¨ State the Laplace transform of the Dirac Delta function as(( )) e as

L t a

d -

- =

¨ Solve differential equations involving the use of the Dirac Delta function

¨ Solve first and second order differential equations with initial conditions using Laplace Transforms

¨ Solve systems of linear differential equations using Laplace Transforms if time permits

Outcome 5 (6 hours)

Use eigenvalues and eigenvectors to solve linear system equations

¨ Introduce the idea of a trivial and non-trivial solution in the context of matrix theory

¨ Define the concept of an eigenvalue (in terms of, for example, the characteristic equation0A

l- =

)

¨ Determine eigenvalues for 2 × 2 and 3 × 3 matrices

¨ Introduce the concept of eigenvectors as the non-trivial solutions X of the equationAX X

l=

¨ Find the eigenvectors for 2 × 2 and 3 × 3 matrices

¨ Solve eigenvalue/eigenvector problems (eg diagonalisation matrices/transformation matrices)

Guidance on approaches to delivery of this Unit

This Unit provides many of the core mathematical principles and processes required when studying engineering at a more advanced level. Given the nature of the subject matter in the Unit it is advisable that the Unit is not delivered until learners have studied Engineering Mathematics 4.

Centres may deliver the Outcomes in any order they wish.

The Unit may be delivery using a didactic approach. All teaching input should be supplemented by a significant level of formative assessment in which learners are provided with opportunities to develop their knowledge, understanding and skills of the mathematical topics covered in the Unit. Alternatively, as learners taking this Unit may be preparing to enter an degree course at university (possibly at an advanced level) the Unit could be delivered as a series of lectures supported by tutorial sessions to help learners prepare

better for future university studies.

Computer software and computer algebra may be used to support learning (eg to confirm the solutions of mathematical problems), but it is strongly recommended that such learning resources are only used in a supportive capacity and not as the principal means of delivering Unit content.

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 10

Guidance on approaches to assessment of this Unit

The recommended approach is the use of an examination question paper. The question paper should be composed of an appropriate balance of short answer, restricted response and structured questions. The questions in the examination should not be grouped by Outcome or be labelled in terms of the Outcomes they relate to.

All assessment papers should be unseen by the learners prior to the assessment event and at all times, the security, integrity and confidentiality of assessment papers must be ensured.

Assessment should be conducted under closed-book, controlled and invigilated conditions.

The summative assessment of all four Outcomes should not exceed two hours and thirty minutes. When assessing a learner's responses to summative assessment lecturers should concentrate principally on the learner's ability to apply the correct mathematical technique and processes when solving problems. Learners should not be penalised for making simple numerical errors. An appropriate threshold score may be set for the assessment of this Unit.

Learners should be provided with a formulae sheet appropriate to the content of this Unit when undertaking their assessment. Computer algebra should not be used in the assessment of this Unit.

It is the learners' responsibility to ensure that any calculator they use during assessment are not designed or adapted to offer any of the following facilities:

¨ language translators

¨ symbolic algebra manipulation

¨ symbolic differentiation or integration

¨ communication with other machines or the internet

In addition, any calculator used by learners should have no retrievable information stored in them. This includes:

¨ databanks

¨ dictionaries

¨ mathematic formulae

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 11

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence.

The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

This Unit has the Using Number component of Numeracy embedded in it. This means that when candidates achieve the Unit, their Core Skills profile will also be updated to show that they have achieved Using Number at SCQF level 6.

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 12

History of changes to Unit

Version Description of change Date

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification

HT1N 48, Engineering Mathematics 5 (SCQF level 8) 13

General information for learners

Unit title: Engineering Mathematics 5 (SCQF level 8)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

The Engineering Mathematics 5 Unit is one of a suite of five Units in Mathematics developed for SQA Advanced Certificates and Diplomas across a range of Engineering disciplines. The five Units help develop the mathematical skills required for workplace roles and for more advanced studies in Engineering, for example, articulation to degree study at university.

The Unit is optional in a number of SQA Advanced Diplomas in Engineering.

This Unit is designed to develop the mathematical skills required by learners who wish to use their SQA Advanced Diploma in Engineering to articulate to university degree study.

You will learn a range of techniques for solving second order differential equations. These equations arise frequently in many areas of engineering. You will develop the knowledge,

understanding and skills to perform partial differentiation and double integration. You will also learn about the very powerful Laplace Transforms method for solving a wide range of differential equations. You will also be introduced to eigenvalues and eigenvectors which are used in the solution of linear system equations.

Unit delivery may comprise of a significant teaching input from your lecturer supplemented by tutorial exercises which will allow you to develop the knowledge, understanding and skills to apply the mathematic principles and processes covered in the Unit to a range of engineering problems. Alternatively, in order to prepare you for studies at university the centre where you are taking the Engineering Mathematics 4 Unit may choose to deliver it as a series of lectures supported by tutorials.

Formal assessment will be through an examination. Assessment will be conducted under closed-book, controlled and invigilated conditions.

Learners considering taking this Unit will normally be expected to have passed the Engineering Mathematics 3 SQA Advanced Unit or equivalent. It also recommended that you have passed the Engineering Mathematics 4 SQA Advanced Unit.sed theHT1R 47,

Fundamentals of Control Systems and Transducers (SCQF level 7) 1

SQA Advanced Unit specification

General information

Unit title: Fundamentals of Control Systems and Transducers

(SCQF level 7)

Unit code: HT1R 47

Superclass: VE

Publication date: August 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to provide learners with a fundamental knowledge of control systems

and their components. It allows learners to study the structure and general behaviour of different types of control systems including open and closed loop types. This Unit also enables learners to develop the knowledge and skills to allow them to understand the operation and application of a range of transducer devices. Learners are provided with the opportunity to construct circuits and systems that incorporate transducers. This Unit acts as a good foundation Unit for more in depth studies in the specialist area of control systems behaviour.

Outcomes

On successful completion of the Unit the learner will be able to:

1 Explain control system elements and signals.

2 Explain the operation and application of a range of transducers used in control systems.

3 Describe the structure and behaviour of control systems.

4 Demonstrate the application of transducers in control systems.

Credit points and level

1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

SQA Advanced Unit Specification

HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 2

Recommended entry to the Unit

Learners should have a general knowledge and understanding of electrical and electronic concepts. This may be evidenced by possession of the SQA Advanced Units: HP46 47 DC and AC Principles, HT7J 46 Analogue Electronics: An Introduction and HT7L 47 Digital Electronics. However, entry requirements are at the discretion of the centre.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Context for delivery

This Unit has been developed for the SQA Advanced Certificate and SQA Advanced Diploma in Electrical Engineering. If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (http://www.sqa.org.uk/sqa/46233.2769.html).

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 3

Unit specification: Statement of standards

Unit title: Fundamentals of Control Systems and Transducers

(SCQF level 7)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment.

Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Explain control system elements and signals.

Knowledge and/or skills

¨ Functions of control system elements and signals

¨ Characteristics of analogue and digital signals

¨ Transmission of analogue signals

¨ Transmission of digital signals

¨ Functions of signal conditioning devices

Outcome 2

Explain the operation and application of a range of transducers used in control systems.

Knowledge and/or Skills

¨ Operation and application of a range of transducers suitable for measuring the following variables: temperature, flow, displacement, velocity, pressure, strain, position, level and light

¨ Properties of transducers

¨ Identification of suitable transducers for various control systems

SQA Advanced Unit Specification

HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 4

Outcome 3

Describe the structure and behaviour of control systems.

Knowledge and/or Skills

¨ Sequence control systems

¨ On-off control systems

¨ Block diagram representation of open and closed loop systems

¨ Transient and steady state behaviour of open loop systems in response to the application of a Unit step input

¨ Transient and steady state behaviour of closed loop systems in response to the

application of a Unit step input

¨ The use of controllers to modify open loop system responses

¨ The use of controllers to modify closed loop system responses

Outcome 4

Demonstrate the application of transducers in control systems.

Knowledge and/or Skills

¨ Construct and demonstrate circuits and systems that incorporate transducers

¨ Operation of circuits and systems that incorporate transducers

¨ Measurement of transducer transfer characteristics

Evidence Requirements for Outcomes 1-3

Written and/or Oral recorded evidence is required for outcomes 1-3 which will be provided on a sample basis. In any assessment of the Outcomes three out of five Knowledge and/or Skills items should be sampled from Outcome 1, two out of three Knowledge and/or Skills items from Outcome 2, and four out of seven Knowledge and/or Skills items from Outcome 3.

In order to ensure that learners will not be able to foresee what items they will be questioned on, a different sample of three out of five Knowledge and/or Skills items from Outcome 1, two out of three Knowledge and/or Skills items from Outcome 2, and four out of seven Knowledge and/or Skills items from Outcome 3 is required each time the Unit is assessed. Learners must provide a satisfactory response to all items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed-book conditions and as such learners must not be allowed to bring any textbooks, handouts, manuals or notes to the assessment.

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HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 5

Where sampling takes place, a learner’s response can be judged to be satisfactory where

the evidence shows the learner can:

Outcome 1

¨ Describe the function of five of the following: controller, error detector, regulator, actuator, transducer, manipulated variable, controlled variable, set point, external output

¨ Describe the characteristics of analogue and digital signals, and compare the advantages/disadvantages of each

¨ Describe the effects of a transmission path on an analogue signal, and describe the desirable properties of a suitable cable used for transmitting analogue signals in a control system

¨ Explain the difference between serial and parallel data transmission, state at least three interface standards and, for each standard, state an appropriate application

¨ Explain the function of three signal conditioning devices

Outcome 2

¨ Explain the operation and application of transducers suitable for measuring two variables from the following list: temperature, flow, displacement, velocity, pressure, strain, position, level and light

¨ Explain four of the following properties of a transducer: range, accuracy, repeatability, sensitivity, resolution, linearity, hysteresis

¨ State a suitable transducer for a given control system

Outcome 3

¨ State an example of a sequence control system and describe the component parts

¨ Describe the behaviour of an on-off type of control system and give an example of an application

¨ Draw a block diagram of a specified closed loop control system consisting of a controller, external input (set point), error detector, error signal, actuator, regulator, manipulated variable, process, controlled variable, feedback loop, transducer and any appropriate signal conditioning devices

¨ Draw a voltage/time graph showing the transient and steady state response of an open loop system in response to a Unit step input. The graph should be labelled with final value, steady state error, and time to settle

¨ Draw a voltage/time graph showing the transient and steady state response of a closed loop system in response to a Unit step input. The graph should be labelled with steady state error, time to peak, time to settle, overshoot and final value

¨ Draw labelled graphs showing the effect of increasing and decreasing gain in an open loop system

¨ Draw labelled graphs showing over damped, under damped, and critically damped behaviour in a closed loop system

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HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 6

Evidence Requirements for Outcome 4

This is a practically based Outcome and all of the Knowledge and/or Skills items should be assessed. The evidence should be presented in response to a practical, laboratory assignment in which each learner is set the task of constructing and demonstrating the operation of a circuit or system that incorporates a transducer.

A learner's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the learner is able to:

¨ Construct and demonstrate correct operation of a circuit or system that incorporates a transducer

¨ Describe the operation of the circuit or system that has been constructed

¨ Measure and plot on a graph, the transducer's output in response to changes at its input

Evidence of the practical aspects of this assignment should be recorded by centres in the form of a checklist for each learner. Each learner is required to construct a circuit or system independently, and then demonstrate to the Assessor its correct operation. If the learner's circuit or system does not operate properly, then the learner should be allowed to correct the

faults and retest the operation at the same assessment event.

On completion of the practical laboratory exercise, learners are required to submit a written laboratory report. This report should include the following sections of information:

¨ purpose of the circuit or system, and relevant circuit or system diagram

¨ brief description of method of construction

¨ description of operation of the circuit or system

¨ record of measured input and output values for the transducer

¨ graph of transducer's transfer characteristic (o/p versus i/p values)

¨ record of observations of the operation of the circuit or system

¨ analysis of recorded values, graph and observations

¨ conclusion conveying the success of the operation of the circuit or system

Centres should provide learners with details of the required report format. Although it should be encouraged, it is not a requirement that learners use software packages to produce documentation for their reports. Centres should make every reasonable effort to ensure that each report is the learner's own work.

The circuit or system that the learner is required to construct and demonstrate can be built using discrete components, pre-constructed modules or a combination of both. Learners should be issued with the circuit or system diagram along with a brief description of its purpose. The circuit or system should be constructed in the laboratory under controlled, supervised conditions, and the written report can be completed outwith the laboratory in the learner's own study time.

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HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 7

Unit Support Notes

Unit title: Fundamentals of Control Systems and Transducers

(SCQF level 7)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit has been written to in order to allow learners to develop knowledge, understanding and skills in the following areas:

1 Explain control system elements and signals.

2 Explain the operation and application of a range of transducers used in control systems.

3 Describe the structure and behaviour of control systems.

4 Demonstrate the application of transducers in control systems.

This Unit is at SCQF level 7 and is included within the SQA Advanced Certificate in Electronics and SQA Advanced Diploma in Electronics. However this does not preclude the use of this Unit in other awards where award designers feel this to be appropriate.

In designing this Unit, the Unit writer has identified the range of topics expected to be covered by lecturers. The writer has also given recommendations as to how much time should be spent on each Outcome. This has been done to help lecturers decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for centres to use this list of topics, it is recommended that they do so since the assessment exemplar pack for this Unit is based on the Knowledge and/or Skills and list of topics in each of the Outcomes.

A list of topics for each Outcome is given below. Lecturers are advised to study this list in conjunction with the assessment exemplar pack so that they can get a clear indication of the standard of achievement expected of learners in this Unit.

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HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 8

1 Explain control system elements and signals (10.5 hours)

The following topics could be covered whilst referring to a variety of specific control system examples:

¨ Purpose of a control system

¨ Practical examples of the requirement for a control system

¨ Element parts of a control system – controller, error detector, actuator, regulator, process, feedback loop and transducer

¨ Signals in a control system – external inputs and outputs, set point, error signal, manipulated variable, controlled variable, and disturbance variables

¨ Characteristics of analogue and digital signals

¨ Comparative advantages/disadvantages of analogue and digital signals

¨ Transmission of analogue and digital signals over short and long distances, and in industrial environments

¨ Serial and Parallel methods of digital signal transmission

¨ Serial and Parallel Standards (eg RS 232, RS 423, RS 422, RS 485, IEEE 488 and IEEE 1284) and their applications

¨ Need for, and functions of signal conditioning devices eg amplifier, filter, A/D and D/A, linearisation circuit, V/I and I/V conversion

2 Explain the operation and application of a range of transducers used in control systems (8 hours)

Basic construction, operation and application of a range of transducers suitable for measuring variables such as temperature, flow, displacement, velocity, pressure, strain, position, level and light.

Examples of devices that could be covered are potentiometers, capacitive displacement transducers, tacho-generators, strain gauges, flow meters, manometers, bourdon tubes, bellows, resistance thermometers, thermocouples, shaft encoders, linear variable differential transformers, photo diodes, light dependant resistors, piezo-electric transducers.

Transducer properties including range, accuracy, repeatability, sensitivity, resolution, linearity and hysteresis

Selection of transducers suitable for specific example control systems.

This Outcome should be taught through practical demonstrations and ‘hands on’ experience of the practical use of transducers in model control systems. This Outcome could be delivered in conjunction with Outcome 4.

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3 Describe the structure and behaviour of control systems (12 hours)

¨ Operation of and examples of sequence control systems eg plc control of industrial processes

¨ Behaviour and example applications of on-off control systems

¨ Behaviour and examples of open loop systems

¨ Behaviour and examples of closed loop systems

¨ Representation in block diagram format of open and closed loop systems

¨ Transient and steady state behaviour of open loop systems in response to the application of a Unit step input:

— Draw a voltage/time graph showing the transient and steady state response of an open loop system in response to a Unit step input. The graph should be labelled with final value, steady state error, and time to settle

— The use of controllers to modify open loop system responses

— Draw labelled graphs showing the effect of increasing gain in an open loop system

¨ Transient and steady state behaviour of closed loop systems in response to the application of a Unit step input:

— Draw a voltage/time graph showing the transient and steady state response of a closed loop system in response to a Unit step input. The graph should be labelled with steady state error, time to peak, time to settle, overshoot and final value

¨ The use of controllers to modify closed loop system responses:

— Draw labelled graphs showing over damped, under damped, and critically damped behaviour in a closed loop system

— Show that controllers can be used to obtain any desired closed loop performance
(with respect to peak, overshoot, settling time, steady state error etc.)

¨ Throughout this Outcome, practical illustrative examples of control systems should be available in the laboratory to allow learners the opportunity to observe their operation and obtain some 'hands on' experience. These could be actual or model control systems that allow the learners to observe and analyse the effects of gain changes, input condition changes etc.

4 Demonstrate the application of transducers in control systems (6 hours)

This is a practically based Outcome. Laboratory exercises are required to allow learners to:

¨ Construct and then investigate the operation of simple control circuits and systems that incorporate transducers

¨ Measure the output of transducers in response to changes in the input quantity

¨ Plot the transfer characteristics for transducers (graphs of output values versus input values)

¨ From the graphs identify any non-linear characteristics and hysteresis

The circuits and systems can be built using discrete components, pre-constructed modules, or a combination of both.

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HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 10

Unit Assessment:

Written Paper 2 hours

Practical Laboratory Assignment 2 hours

Guidance on approaches to delivery of this Unit

Throughout the delivery of this Unit, reference should be made to practical examples of control systems. A range of transducers should be available for learners to view. Practical demonstrations and/or laboratory exercises showing the operation of transducers and model control systems should be provided throughout the Unit.

This Unit has been developed as part of the SQA Advanced Certificate and SQA Advanced Diploma in Electrical Engineering awards. Where this Unit is incorporated into other Group Awards it is recommended that it be delivered in the context of the specific occupational area(s) that the award is designed to cover.

Details on approaches to assessment are given under Evidence Requirements and Assessment guidelines under each Outcome in the SQA Advanced Unit specification: statement of standards section. It is recommended that these sections be read carefully before proceeding with assessment of learners.

The written assessment paper should take place after delivery of the Unit is complete.

The practical laboratory assignment can be carried out during the delivery of the Unit.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

The assessment for all Outcomes 1, 2 and 3 in this Unit should be combined together into one written assessment paper. This paper should be taken by learners at one single assessment event that should last two hours. The assessment paper should be composed of a suitable balance of short answer, restricted response and structured questions. This assessment should be carried out at the end of the delivery of the Unit and be conducted under controlled, supervised conditions.

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Outcome 4 should be assessed by a practical, laboratory assignment in which each learner is set the task of constructing and demonstrating the operation of a circuit or system that

incorporates a transducer. On successful completion of the practical aspects of this assignment, learners should be required to submit a written laboratory report. The time that should be allocated in the laboratory for this assignment is 2 hours. However, learners should be allowed to complete the written report outwith the laboratory in their own study time. The assessment for Outcome 4 should be carried out at a suitable time during the delivery of the Unit.

Assessment Guidelines

Outcomes 1-3

The assessment for Outcomes 1, 2 and 3 should be combined together to form one assessment paper. This single assessment paper should be taken at a single assessment event lasting two hours and be carried out under supervised, controlled conditions. Such a paper should be composed of an appropriate balance of short answer, restricted response and structured questions. This assessment should be taken at the end of the Unit.

Outcome 4

The assessment of this Outcome should take the form of a practical, laboratory assignment which can be carried out at a suitable time during the delivery of the Unit. The time that should be allocated in the laboratory for this assignment is 2 hours. However, learners should be allowed to complete the written report outwith the laboratory in their own study time. It is recommended that centres develop checklists to support the assessment requirements for each of the Knowledge and/or Skills items.

It is essential that centres ensure that evidence generated is the learner's own work. Centres can choose to issue each learner with the same circuit or system to be constructed, or a different circuit or system to be constructed. If different circuits or systems are issued then each one must possess the same degree of difficulty.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT),

such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

There may be opportunities to gather evidence towards the following Core Skills or Core Skills components in this Unit, although there is no automatic certification of Core Skills or Core Skills components:

¨ Written Communication (Reading) at SCQF level 6

¨ Written Communication (Writing) at SCQF level 6

¨ Using Graphical Information at SCQF level 6

¨ Critical Thinking at SCQF level 6

¨ Working with Others at SCQF level 4

History of changes to Unit

Version Description of change Date

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification

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General information for learners

Unit title: Fundamentals of Control Systems and Transducers

(SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

A control system consists of a number of components (which can be electrical, mechanical, thermal or hydraulic) that act together to maintain a desired output in a process. Control systems are used extensively in industries such as oil refining, electrical generation, chemical processing, and manufacturing and production. Our homes and offices also use control systems to regulate temperature and air conditioning. This Unit has been designed to enable you to develop the necessary knowledge and skills so you to understand the structure and general behaviour of different types of control systems.

The Unit takes a non-mathematical approach to control systems. You will learn how to explain control system concepts, use block diagrams to model systems, and use graphical methods to describe their behaviour.

You will begin the Unit by learning about the types of component parts that make up control systems. You will also learn how information is transferred between the component parts by means of analogue and digital signals. You will discover that the operation of a control system is heavily influenced by its environment, and that the choice of equipment and signal types depends on the location of the system. The need for signal conditioning devices such as filters and amplifiers will be covered.

As you progress through the Unit, you will learn about different methods of controlling the

output of a process. Basic methods such as open loop control will be covered. However, these have limitations and disadvantages. Therefore, you will learn about the need for closed loop control systems which have the facility to measure the output variable being controlled, so as to sense changes and enable corrective action to be taken to ensure that the output of the system is maintained at the desired value. Such control systems include temperature control and flow control of liquids. You will also develop knowledge and skills to enable you to understand how controllers can be used to modify the way open and closed loop control systems respond (with respect to speed of response, damping, and transient and steady state response).

Closed loop control systems incorporate devices called transducers. These accept energy in one form eg heat and produce output energy in some other form such as an electrical signal. You will study the operation and application of a range of transducers suitable for measuring variables such as temperature, flow, displacement, velocity, pressure, strain, position, level and light. In addition, you will have the opportunity to construct circuits and systems that incorporate transducers. You will measure the characteristics of transducers, and study the overall operation of the circuits and systems that you build.

By the end of this Unit you should possess the knowledge and skills to enable you to: explain control system elements and signals; explain the operation and application of a range of transducers; describe the structure and behaviour of control systems; and demonstrate the application of transducers in control systems.

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HT1R 47, Fundamentals of Control Systems and Transducers (SCQF level 7) 15

The formal assessment for the Unit will consist of a both a written assessment paper lasting two hours and a laboratory assignment lasting two hours.

The written assessment paper will be conducted under closed-book conditions and you will not be allowed to take notes, textbooks etc into the assessment. You will sit this assessment paper at the end of the delivery of the Unit.

The laboratory assignment will require you to construct and demonstrate the operation of a circuit or system that incorporates a transducer. This will be carried out during a two hour laboratory session at a suitable time during the delivery of the Unit. On successful completion of the practical aspects of this assignment, you will be required to submit a written laboratory report.

Engineering Mathematics 3 SQA Advanced Unit or equivalent.

QA Advanced Certificate and SQA Advanced Diploma qualifications provide practical skills and theoretical knowledge that meet the needs of employers.

The SQA Advanced Certificate in Electrical Engineering at SCQF 7 covers areas such as:

Electrical Principles

Information Technology

Three Phase Induction Motors

Power Electronics

Inspection and Testing of Low Voltage Electrical Installations

Programmable Logic Controllers

Electrical Systems in Hazardous Environments

Control Systems

Further Mathematical studies

Electrical Installation Skills

Engineering Quality

The SQA Advanced Diploma in Electrical Engineering at SCQF 8 builds on the knowledge and skills of the SQA Advanced Certificate and covers areas such as:

Inspection and Testing of Low Voltage Installations

Programmable Logic Controllers

Electrical Systems in Hazardous Environments

Analogue and Digital Electronics

Quality Management

Electrical Installation Skills

Industrial Plant Maintenance

Synchronous Machines

Electrical Motor Drive Systems

Three Phase Induction Motors

High Level Engineering Software

Additional Control Systems studies

Power Supply Circuits

Switchgear and Protection

Standby Systems

Electrical Installation Design: Computer Aided

Advanced Mathematical studies

Qualification structure

SQA Advanced Certificate in Electrical Engineering

Group award code: GP6D 47 (96 SCQF credit points)

SQA Advanced Certificate in Electrical Engineering at SCQF level 7 consists of 9 mandatory units.

SQA Advanced Diploma in Electrical Engineering

Unit title: High Level Engineering Software

Unit code: HP41 47

Unit purpose: This Unit is designed to give candidates knowledge and understanding and apply

basic software engineering concepts to solving electrical and electronic engineering problems that

require a software solution. The emphasis in this Unit is on writing and testing and documenting I/O

programs using the basic structures available in most high level languages.

This Unit provides the candidates with the opportunity to develop skills in system design (top-down

design), detailed design (using flow charts or program design language), implementation in the design

in a high level language and verification of the design. This Unit also allows the candidates to develop

their communication skills by generating the documentation for the designed solution.

On completion of the Unit the candidate should be able to:

1 Write, test and document linear programs using I/O statements.

2 Write, test and document I/O programs using conditional statements.

3 Write, test and document I/O programs using iterative loop statements.

4 Write, test and document an I/O program, incorporating subroutines.

Credit value: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications

Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an

SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.

Recommended prior knowledge and skills: Candidates should have a basic knowledge

of electronics, logic operations and number systems. This may be evidenced by possession of a

Higher in Electronics or the following National Qualification Units D134 11 Combinational Logic or

E9LG 11 Computing in Engineering 1 or D980 11 Programmable Systems.

Core Skills: There may be opportunities to gather evidence towards Core Skills in this Unit,

although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: This Unit was developed for the SQA Advanced Certificate/Diploma in

Electronics award. If the Unit is used in another Group Award(s) it is recommended that it should be

taught and assessed within the context of the particular Group Award(s) to which it contributes. The

platform for this Unit may be a micro-controller system or a standard personal computer with access

to I/O ports.

SQA Advanced Unit Specification

Unit HP41 47: High Level Engineering Software 2

Assessment: It is recommended that this Unit be assessed via a logbook or portfolio and

programming projects or assignments that cover the knowledge and skill presented in each Outcome.

Centres should take every reasonable effort to ensure that reports are the candidates' own work. It

may be possible to issue each candidate with a slightly different specification of equal complexity, or

alternatively where there is a suspicion of copying or plagiarism, an appropriate response may be to

interview candidates. A checklist should be used to record oral evidence of the candidates'

understanding.

Centres are recommended to develop appropriate checklists to support the assessment requirements

for each of the knowledge and skills items. Centres are also recommended to produce a marking

schedule based on the Evidence Requirements listed indicating clearly the required content of the

report. Candidates who do not meet the standard should be obliged to correct and resubmit their work.

SQA Advanced Unit Specification

Unit HP41 47: High Level Engineering Software 3

Unit specification: statement of standards

Unit title: High Level Engineering Software

Unit code: HP41 47

The sections of the Unit stating the Outcomes, knowledge and/or skills, and Evidence Requirements

are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the

Knowledge and/or Skills section must be taught and available for assessment. Candidates should not

know in advance the items on which they will be assessed and different items should be sampled on

each assessment occasion.

Outcome 1

SQA Advanced Unit Specification

Unit HP41 47: High Level Engineering Software 4

Evidence Requirements

Evidence for the Knowledge and/or Skills in this Outcome will be provided on a sample basis in the

form of a portfolio. The candidate's response will be judged to be satisfactory where evidence

provided is sufficient to show that the candidate is able to:

Write, test and document ONE non-linear I/O program involving:

¨ conditional statements with logic operators

¨ multi-way selection statement

Outcome 3

Write, test and document I/O programs using iterative loop statements

Knowledge and/or Skills

¨ Flowcharts/pseudo code: FOR...DO, REPEAT…UNTIL, WHILE… loops

¨ Statements: FOR...DO, REPEAT…UNTIL, WHILE…

¨ Loops to manipulate data arrays:

— output array data to a port

— read port data into an array

¨ Testing of iterative loops

¨ Test plan and actual results

Evidence Requirements

Evidence for the Knowledge and/or Skills in this Outcome will be provided on a sample basis in the

form of a portfolio. The candidate's response will be judged to be satisfactory where evidence

provided is sufficient to show that the candidate is able to:

Write, test and document ONE non-linear program involving an iterative loop

¨ the program must include a conditional statement inside the iterative loop OR and iterative loop

must be a part of the conditional statement

Outcome 4

Write, test and document an I/O program, incorporating subroutines

Knowledge and/or Skills

¨ Procedures/functions

¨ Bit-wise logical operations: AND, OR and EOR

¨ Identifying port signals and their functions

¨ Test plan and actual results

¨ Documentation

Evidence Requirements

Evidence for the Knowledge and/or Skills in this Outcome will be provided on a sample basis in the

form of a portfolio. The candidate's response will be judged to be satisfactory where evidence provided is sufficient to show that the candidate is able to:

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Unit HP41 47: High Level Engineering Software 5

Write, test and document a basic input/output ports program, which includes:

¨ procedures/functions

¨ bit-wise logical operation.

¨ a conditional statement

¨ an iterative loop

the documentation to include:

¨ statement of the problem

¨ flowchart/algorithm

¨ program coding with comments

¨ testing and actual results

¨ conclusion

SQA Advanced Unit Specification

Unit HP41 47: High Level Engineering Software 6

Administrative information

Unit code: HP41 47

Unit title: High Level Engineering Software

Superclass category: CB

Original date of publication: August 2017

Version: 01

History of changes:

Version Description of change Date

Source: SQA

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SQA Advanced Unit Specification

Unit HP41 47: High Level Engineering Software 7

Unit specification: support notes

Unit title: High Level Engineering Software

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit has been written in order to allow candidates to develop the knowledge, understanding and skills in the area of Software Engineering by writing and testing I/O programs. The following processes illustrate Software Engineering:

¨ user requirements

¨ problem specification

¨ system design (partitioning into manageable tasks)

¨ detailed design (design of individual modules)

¨ implementation (coding into chosen programming language)

¨ program verification (software testing)

¨ program maintenance (extending the program for the future)

With validation and documentation taking place at all the stages.

This Unit was designed to permit the candidates to apply the software engineering techniques to formulate the solutions to engineering tasks involving input and output ports. Software may be developed for a PC or single board computer or a micro-controller in conjunction with an applications board. Candidates may be provided with subprograms to configure and read/write input/output ports.

This Unit was developed as one of four SQA Advanced Certificate/Diploma in Engineering Programming options and is at SCQF level 7. This Unit should be completed before tackling the level 8 Unit, High Level Language: External I/O Transfer.

The Unit has identified the topics that are expected to be covered by lecturers. The Unit also gives recommendations as to how much time should be spent on each Outcome. This has been done to help lecturers to decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for a centre to use this list of topics it is strongly recommended that they do so to ensure continuity of teaching and learning across the Engineering Computing Units and because the assessment exemplar pack for this Unit is based on the Knowledge and/or Skills and list of topics in each of the Outcomes.

A list of topics is given below. Lecturers are advised to study this list in conjunction with the assessment exemplar pack for this Unit so they can get a clear indication of the standard of achievement expected of candidates taking the Unit.

1 Write, test and document linear programs using I/O statements (10 hours)

User Requirements and analysis

Problem Specification

Top-down design

Hardware

SQA Advanced Unit Specification

SQA Advanced Unit Specification

Guidance on the delivery and assessment of this Unit

This is the first engineering programming Unit on the SQA Advanced Certificate/Diploma Electronics

and for many candidates this may be their first encounter with programming. In this respect it may be

advisable to deliver this Unit on a free-standing basis.

Each candidate should have access to a computer loaded with appropriate OS and High Level

Language software. Additionally workstations should be available on which candidates are able to test

I/O based programs.

Delivery of all the Outcomes may be carried out using an LCD projector so that the candidates can

view the actual code of the sample programs and see their execution with prepared test data in real

terms.

SQA Advanced Unit Specification

Unit HP41 47: High Level Engineering Software 10

This introductory Unit should be used to develop the candidate's confidence in the basic

programming concepts and as such should be taken before considering assembly language

programming.

It is suggested that the Unit assessment take the form of a logbook or portfolio covering the four

Outcomes.

For example, assuming a two-hour class per week, then over a 20-week period the assessment schedule may be:

Weeks 1 to 5 Linear programming

Outcome 1 assignments completed (2hours)

Weeks 6 to 10 Non-linear programming for I/O ports using selection statements

Outcome 2 assignments completed (2hours)

Weeks 11 to 15 Non-linear I/O programming using iterative loops

Outcome 3 assignments completed (2hours)

Weeks 16 to 20 I/O programming using bit-wise operations

Outcome 4 assignments completed (4hours)

Open learning

This Unit is more suitable for laboratory delivery however it could be delivered by distance learning

provided the candidate has the appropriate hardware. This may require some degree of on-line

support. However, with regard to assessment, planning would be required by the centre concerned to

ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be

put in place to ensure that assessment whether done at a single or at multiple events was conducted

under controlled, supervised conditions.

To keep administrative arrangements to a minimum, it is recommended that a single assessment paper

(taken by candidates at a single assessment event) be used for distance learning candidates.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to

learning or assessment. The individual needs of learners should be taken into account when

planning learning experiences, selecting assessment methods or considering alternative

evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

Unit HP41 47: High Level Engineering Software 11

General information for candidates

Unit (HV2K 47): Industrial Plant Maintenance 1

SQA Advanced Unit Specification

General information for centres

Unit title: Industrial Plant Maintenance

Unit code: HV2K 47

Unit purpose: This Unit is designed to introduce candidates to the planning and organisation of

maintenance programmes for industrial plant. The Unit allows candidates to develop the knowledge

and skills necessary to select an appropriate style of maintenance program suitable for a particular

industrial setting, whilst implementing the necessary health and safety procedures.

On completion of the Unit the candidate should be able to:

1. Explain standard techniques involved in plant maintenance.

2. Explain typical health and safety regulations pertaining to plant maintenance systems.

3. Develop a maintenance strategy for a given simple industrial scenario.

Credit points and level: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level

7*)

*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications

Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an

SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.

Recommended prior knowledge and skills: Candidates should have a basic knowledge

of either mechanical or electrical principles and technology. However, entry requirements are at the

discretion of the centre.

Core Skills: There may be opportunities to gather evidence towards the following Core Skills or

Core Skills components in this Unit, although there is no automatic certification of Core Skills or

Core Skills components:

¨ Written Communication (reading) at SCQF level 6

¨ Written Communication (writing) at SCQF level 6

¨ Using Graphical Information at SCQF level 5

¨ Using Information Technology at SCQF level 5

¨ Problem Solving at SCQF level 6

¨ Working with Others at SCQF level 4

Context for delivery: This Unit was developed for the SQA Advanced Diploma in Electrical

Engineering award. If the Unit is to be used in another group award it is recommended that it should

be taught and assessed within the subject area of the group award to which it contributes.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 2

Assessment: The assessment for this Unit will consist of two parts. An assessment paper is used

to cover Outcomes 1 and 2 and an assignment/report to assess Outcome 3. Candidates will sit the

assessment paper at one single assessment event lasting one and a half hours. The assessment paper

should be composed of a suitable balance of short answer, restricted response and structured

questions. This assessment should be conducted under controlled, supervised conditions. For

Outcome 3, candidates will devise a maintenance plan for a given industrial scenario, and write a

short report justifying the plan. The assessment paper should be carried out after the delivery of

Outcome 2 and the assignment should be submitted after the completion of the Unit.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 3

SQA Advanced Unit Specification: statement of standards

Unit title: Industrial Plant Maintenance

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements

are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the

knowledge and/or skills section must be taught and available for assessment. Candidates should not

know in advance the items on which they will be assessed and different items should be sampled on

Outcome 1

Explain standard techniques involved in plant maintenance.

Knowledge and/or skills

¨ Reactive Maintenance (RM)

¨ Planned Preventative Maintenance (PPM)

¨ Total Productive Maintenance (TPM)

¨ Reliability Centred Maintenance (RCM)

¨ Condition Monitoring (CM)

Outcome 2

Explain typical health and safety regulations pertaining to plant maintenance systems.

Knowledge and/or skills

¨ Basic understanding of the typical health and safety issues arising as a result of plant

maintenance procedures.

¨ Awareness of the need to comply with all statutory health and safety requirements.

¨ Basic understanding of Risk Assessment

¨ Basic understanding of COSHH, noise related health and safety regulations, PPE

¨ Understanding of Permit to Work procedures.

Evidence Requirements

Evidence for the knowledge and/or skills in Outcomes 1 and 2 will be provided on a sample basis.

The evidence may be presented in response to specific questions. Each candidate will need to

demonstrate that she/he can answer correctly, questions based on a sample of the items shown under

the knowledge and skills shown above. In any assessment of this Outcome three out of five

knowledge and/or skills items should be sampled for Outcome 1 and three out of five knowledge

and/or skills items should be sampled for Outcome 2.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 4

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a

different sample of three out of five knowledge and/or skills items from Outcome 1 and three out of

five knowledge and/or skills items from Outcome 2 are required each time the Unit is assessed.

Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence

provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

Outcome 1

¨ Describe Reactive Maintenance, discuss the advantages and disadvantages of RM.

¨ Explain Planned Preventative Maintenance, giving examples of industrial scenarios where PPM

is valid.

¨ Explain Total Productive Maintenance (TPM)

¨ Explain the basic principles of Reliability Centred Maintenance (RCM).

¨ Describe the application of Condition Monitoring in industrial plant maintenance.

Outcome 2

¨ Explain the typical health and safety issues arising as a result of plant maintenance procedures.

¨ Explain the duties of employees and employers with regard to complying with relevant health and

safety legislation.

¨ Explain the basic procedure involved in Risk Assessment

¨ Explain specific legislation relating to health and safety, such as, COSHH, noise, PPE.

¨ Explain typical permit to work systems.

Evidence should be generated through assessment undertaken in controlled, supervised conditions.

Assessment should be conducted under closed book conditions and as such candidates should not be

allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be permitted to

use scientific calculators during the assessment.

Assessment guidelines

The assessment for Outcomes 1 and 2 should be combined together to form one assessment paper.

This single assessment paper should be taken at a single assessment event lasting one and a half hours

and carried out under supervised, controlled conditions. Such a paper should be composed of an

appropriate balance of short answer, restricted response and structured questions.

Outcome 3

Develop a maintenance strategy for a given simple industrial scenario.

Knowledge and/or skills

¨ Requirements of a Maintenance Policy.

¨ Role of Plant records and history.

¨ Use of bar charts for planning maintenance work.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 5

¨ Basic understanding of how CMMS (Computerised Maintenance Management system) software

can contribute to setting up and running of plant maintenance systems.

¨ The various factors affecting cost effectiveness.

¨ Appreciate importance of skills and qualifications of workforce.

¨ Understand the need to prioritise tasks based on critical path analysis.

Evidence Requirements

All knowledge and /or skills items in Outcome 3 should be assessed. Evidence for Outcome 3 will be

provided by means of an assignment. The candidate will compile a maintenance program suitable for

a given simple industrial scenario. This should be an electrical/mechanical plant setting appropriate

to the candidate’s own industrial experience or area of study. The candidate’s response will include

the necessary documentation such as, maintenance schedules, standard operating procedures and

relevant health and safety considerations. CMMS software, if available, can be employed in

completing the assignment. A report of not less than 800 words plus diagrams, appendices etc.

justifying the chosen strategy should be submitted as part of the assignment. The report should also

include an explanation of how CMMS software, where used, is employed in the maintenance

program, or alternatively where the software is not used, how it would be employed if available. The

industrial scenario will be of sufficient complexity, that the response, along with the report, will

cover the knowledge and skills items listed for Outcome 3.

Outcome 3

¨ Demonstrate awareness of typical organisational requirements of a Maintenance Policy.

¨ Demonstrate awareness of the role of plant records and history.

¨ Demonstrate the use of bar charts/graphs etc in the planning of maintenance work.

¨ Explain/demonstrate how CMMS software can contribute to the running of plant maintenance

systems.

¨ Explain the various factors affecting cost effectiveness of a maintenance policy.

¨ Explain the importance of skills and qualifications of the workforce.

¨ Explain the necessity to prioritise tasks based on critical path analysis.

Assessment Guidelines

Evidence for this Outcome should be gathered by means of the candidate preparing a maintenance

program and a report, related to a given industrial scenario. This should cover all the knowledge and

skills items for this Outcome. Centres may wish to issue candidates with guidance notes relating to

both the assignment itself and the report.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 6

Administrative Information

Unit code: HV2K 47

Unit title: Industrial Plant Maintenance

Superclass category: VG

Date of publication: November 2017

Version: 01

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 7

SQA Advanced Unit Specification: support notes

Unit title: Industrial Plant Maintenance

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit has been written in order to allow candidates to develop their knowledge and competence in the following areas:

1. Standard techniques involved in plant maintenance.

2. Typical health and safety regulations pertaining to plant maintenance systems.

3. Organisational requirements of successful plant maintenance systems and the role of CMMS software.

Guidance on the delivery and assessment of this Unit

Delivery of this Unit should relate to Current Codes of Practice and legislation eg

¨ Health and Safety at Work Act, 1974 (HSW Act)

¨ Electricity at Work Regulations 1989

¨ The Management of Health and Safety at Work Regulations 1999

¨ IEE Wiring Regulations (current edition) BS7671

1. Explain standard techniques involved in plant maintenance. (14 hours)

¨ RM: advantages/disadvantages, where applicable.

¨ PPM: highlight where PPM is applicable. Discuss advantages such as: more even spread of maintenance work, better budgetary control, fewer emergency breakdowns, extension of working life of plant, scheduling of maintenance at organisationally convenient or economically beneficial time.

¨ TPM: advantages. Highlight the importance of staff training/cooperation. Discuss overall equipment effectiveness (OEE).

¨ RCM: explain how this stresses the maintenance of items critical to the continued reliable operation of plant. Attempts to maximise reliability. Seeks to eliminate unnecessary preventative maintenance.

¨ Condition Monitoring: explain CM, Monitoring vibration, temperature, thermal imaging, allows recording of trends and comparisons with initial base line measurements. Allows remedial measures to be taken before breakdown. Give examples such as monitoring of high voltage cables, steam turbines and generators. Explain that conditions are monitored according to the most likely failure modes expected. CM Software allows viewing of history in graphs, charts etc

and publishing of reports.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 8

2. Explain typical health and safety regulations pertaining to plant maintenance systems. (11 hours)

¨ Highlight the necessity of being informed of, and complying with, all statutory health and safety requirements.

¨ Responsibilities for personnel under Health and Safety at Work Act 1974, Management of Health and Safety at Work Regulations 1999. Explain Hazard and risk and give typical examples.

Explain the rudiments of sensible risk assessment procedure.

¨ Explain provisions of COSHH regulations. The need to protect personnel from potentially dangerous substances either through removal of substance or provision of appropriate PPE.

Explain noise hazards. Noise related health and safety regulations.

¨ Explain the purpose of the permit to work procedure and the need to identify all potentially hazardous work activities to be carried out and the measures required to minimise any risks.

Highlight the need for an operational plan involving safe isolation and locking off.

¨ Give examples of typical health and safety issues, which arise as a result of plant maintenance procedures pertinent to the industry, within which the candidate is involved.

3. Develop a maintenance strategy for a given simple industrial scenario. (14 hours)

This Outcome should provide the candidate with an opportunity to apply the principles of plant maintenance learned, to a given industrial scenario.

¨ Organisational requirements of a maintenance Policy, administrative structures, analysis of particular industrial scenarios so that appropriate maintenance strategies, including safe systems of work, are employed.

¨ Recording of information and updating plant records, spares inventories and standard operating

procedures for plant.

¨ Value of using charts and graphs in analysing the history of particular systems and planning of

plant maintenance.

¨ Importance of employing cost effective strategies for maintenance.

¨ Importance of ensuring skills and qualifications of workforce are adequate, diagnostic skills,

fitting skills, electrical engineers, plant servicing skills, etc. Vocational qualifications and

experience.

¨ Value of critical path network analysis techniques.

¨ Contribution of CMMS software in the management of plant maintenance systems.

Assessment :

The assessment for this Unit will be composed of two parts. A single assessment paper lasting one

and a half hours carried out under supervised controlled conditions and an assignment. It is

recommended that the assignment is presented to the candidates toward the conclusion of Outcome 2

and should be completed before the end of the delivery of the Unit.

Open learning

This Unit could be delivered on an open learning basis. The centre would have to ensure that the

written assessment was carried out under controlled and supervised conditions.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 9

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning

or assessment. The individual needs of learners should be taken into account when planning learning

experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

Unit (HV2K 47): Industrial Plant Maintenance 10

General information for candidates

Unit title: Industrial Plant Maintenance

This Unit has been designed to allow you to develop the knowledge and skills involved in setting up a

plant maintenance policy. The initial part of the course involves an introduction to current standard

techniques employed in plant maintenance. In the maintenance of industrial plant there are often

many issues relating to health and safety, therefore Outcome 2 focuses on the typical health and

safety regulations pertaining to plant maintenance systems. Permit to work, risk assessment and

responsibilities of employers and employees under the health and safety at work act are all examined.

During the delivery of the concluding Outcome you will have the opportunity to develop an

understanding of computerised maintenance management system software. Also you will able to

apply what you are learning, by way of an assignment and report. In this, you will develop a program

of maintenance for an industrial scenario and a report justifying your program. The particular

industrial setting will be drawn as closely as possible from your own industrial experience or area of

study.

Formal assessment will be composed of two parts:

1. A written test lasting one and a half hours based on what you have learned in the first two Outcomes in the Unit.
2. A combined assignment and report.

SQA Advanced Unit Specification

General information

Unit title: Information Technology: Applications Software 1

(SCQF level 7)

Unit code: HP6L 47

Superclass: CY

Publication date: August 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This unit is designed to enable students to use Information Technology (IT) systems and applications independently to support a range of information processing activities. The unit is designed to develop a broad knowledge of the theoretical concepts, principles, boundaries and scope of IT applications. These activities will be centred on using software applications packages to meet complex information requirements while paying attention to security and the needs of other users.

Outcomes

On successful completion of the unit the learner will be able to:

1 Operate a range of IT equipment independently, giving attention to security and to other users.

2 Use a range of software application packages to meet complex information requirements.

Credit points and level

1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 2

Recommended entry to the Unit

Access to this unit will be at the discretion of the Centre, however it is recommended that learners should have sound keyboard and mouse skills and a thorough familiarity with computers and software packages. These skills may be evidenced by the achievement of appropriate National Units or Courses but they may also have been acquired in an informal or work environment.

For Core Skills it would be beneficial if learners had some IT skills. This could be demonstrated by the achievement of the Core Skill Using Information Technology at SCQF level 5 or equivalent.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this unit specification.

This unit gives automatic certification of the core skill: Using Information Technology at SCQF level 6.

Context for delivery

This unit is included in the framework of a number of SQA Advanced Group Awards. It is recommended that it should be taught and assessed within the particular Group Award to which it contributes.

The Assessment Support Pack (ASP) for this unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to

learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 3

Unit specification: statement of standards

Unit title: Information Technology: Applications Software 1

(SCQF level 7)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment.

Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Operate a range of IT equipment independently, giving attention to security and to other users.

Knowledge and/or Skills

¨ The different components of a computer system and how to use them, (ie mouse or other pointing device, keyboard, monitor, disk drive, processor, printer, scanner, etc)

¨ The functions of tools such as file managers, print managers, control panels and how to use these

¨ The ways in which data can be kept secure, (eg encryption, passwords, back ups, virus protection) and how security procedures can be used to meet the needs of all users of a computer system

¨ The causes of some common software and hardware problems, (eg cable connections, device settings, software option settings) and what action to take to resolve these

Outcome 2

Use a range of software application packages to meet complex information requirements.

Knowledge and/or Skills

¨ Methods for assessing information requirements and designing solutions using IT

¨ How to use straightforward and complex features of a range of software application packages (these can be word processing, spreadsheet, database, simulation, graphics, communications, (ie internet, intranet, email, etc), audio/music, animation, video, multimedia, desktop publishing, data logging and retrieval, control or other packages)

¨ How to integrate data types within a software application package

¨ How to integrate information from more than one software application package

¨ The content and search facilities of a range of computer data sources

¨ Factors to consider when working out a search strategy when using a computer data source

¨ How to extract information from a local and a remote computer data source

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 4

Evidence Requirements for this Unit

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

Outcome 1

¨ Use five hardware devices, (eg mouse, keyboard, printer, monitor, disk drive, scanner)

¨ Start up and close down the operating system

¨ Open and close software packages

¨ Locate data and applications

¨ Use a filing system, (eg to organise folders and sub-directories applying naming

conventions)

¨ Use two tools within the operating system, (eg file managers, print managers and control panels)

¨ Implement security measures responsibly and with consideration for the needs of other users, (eg passwords, backups, virus protection)

¨ Resolve one hardware and one software problem, (eg printer off-line, sound not working, too many open programs, system freeze, software option settings, etc)

Outcome 2

¨ Identify the information requirements of users and how these requirements can be met

¨ Select software applications packages which are appropriate to meet the identified information requirements

¨ Use four or more software applications packages to process the identified information requirements and which output two or more different data types, (eg text, number, graphics, audio, video) in the form of documents, designs, compositions, models or presentations

¨ Carry out three searches to extract and present relevant information from suitable local and remote computer data sources. A minimum of two searches must be from remote computer data sources. To do this the learner will be required to:

— Plan how to find the information and make decisions about searches taking account of efficiency in terms of time, cost, effective filtering and Outcome

— Extract information, (eg text, number, graphics, audio, video) which matches several search criteria, (eg keywords, fields, file names, screen grabber, digital camera or scanner). Searches must be different from each other, eg searching two different sources, or searching the same source for two different forms of information

¨ Integrate two or more different data types, (eg text, number, graphics, audio, video) from more than two software applications packages into a single product. The product may be in the form of a document, design, composition, model or presentation

¨ Format the product so that the final output meets the identified information requirements and is clear and helpful to users

The evidence for this Outcome should be in the form of a document, design, composition, model or presentation covering all the Evidence Requirements shown above.

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 5

Unit support notes

Unit title: Information Technology: Applications Software 1

(SCQF level 7)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This unit provides a solid basis on which further IT skills can be built. It will enable learners to use IT systems with minimal support, paying due regard to security. Electronic data sources are to be used, learners are expected to achieve effective results when using IT software in an unfamiliar context by using on-line help facilities and suppliers' handbooks. Basic configuration and fault-finding skills are to be taught. Files should be provided for learners as appropriate to negate the need for them to enter large amounts of text or data.

This unit is very much aimed at enabling learners to obtain and use data and software applications packages associated with the internet and email, ie electronic communications. Therefore, there should be considerable emphasis placed upon providing access to appropriate data and software associated with electronic communications. Candidates should then be encouraged to learn for themselves the benefits of being able to integrate information from diverse sources and produce documents, designs, compositions, models or presentations of a complex nature.

The unit can be approached from the standpoint of using information technology to support a

range of information processing activities. The learner should be able to plan for, develop and produce the relevant information requirements of users.

Candidates should achieve the level of competence required of a regular user of IT applications software in a commercial or professional situation. Candidates will require individual access to a personal computer/workstation. It is suggested that, wherever possible, commercially available current versions of industry standard software be used. The component parts of an integrated software package along with its operating environment can be used to achieve all Outcomes. This should not be prohibitive in the case of the centres, but may be an issue if being undertaken in the workplace.

It is generally assumed that the environment for this unit will be, for example, Microsoft Windows and Office 97/2000 or Lotus, or other vendor equivalents, however, this is not specified and the Outcome requirements are deliberately generic in nature.

Outcome 1 looks at the components of hardware, the functions of operating system tools and how these are used. Data security measures, resolving common hardware and software problems are also pre-eminent. All of the elements should be taught in the context of giving attention to the needs of other users of a computer system.

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 6

Outcome 2 looks at using a range of software packages to meet complex information requirements. Centres can choose four or more packages (a minimum of four different packages must be used) from the whole range of applications packages available. The software application packages chosen must be relevant to the vocational area of the Group Award undertaken by the learner. The emphasis in this Outcome should be on producing complex information in a context that is unfamiliar to the learner. Candidates should be able to integrate data types, (eg text, number, graphics, audio, video) into a single product and to format the product so that the final output is clear and helpful to users. Candidates should show that they can plan for the information requirements; select and use software packages

appropriate to information requirements; select suitable computer data sources for information and extract suitable information from these computer data sources to meet relevant requirements.

An indication of the range of activities that learners are expected to be able to carry out when using a variety of software applications packages during the course of this unit is given below for some of the 'standard' applications that centres may use. This should not be taken to be a 'prescriptive', or indeed, an exhaustive list of requirements but should help to serve as a guide to the level of skills required.

1 Selection and use of appropriate software applications packages and electronic data sources from both local and remote computers.

2 Selection and use of document layout, page layout and format facilities, eg: views, use of toolbars, rulers, guides, zoom, fonts, bullets and numbering, borders and shading, tabs, case, dropped capitals, columns, themes, backgrounds, styles, frames, colours and lines, alignment, templates, auto-format.

3 Use of on-line help and tutorial support facilities.

4 File Handling, eg properties, naming conventions, saving, saving for use with web and other applications, retrieving, retrieving from web and other applications, copying, renaming, importing, exporting, emailing, attachments, routing, and faxing.

5 Editing, eg undo, repeat, cut, copy, paste, paste special, select all, fill, clear, find, replace, go to, rename, links, and objects.

6 Selection and use of insertions, eg headers and footers, page breaks, comments, footnotes, captions, numbering, symbols, date and time, index and tables, bookmarks, pictures, objects, hyperlinks, graphics, movies, sounds, tables, queries, forms and reports, functions, charts, comments, fields, records and files.

7 Use of 'tools', eg spelling and grammar checker; thesaurus; search and replace; auto-correction; sort; merge; customisation; options; security; protection; macros (simple); on-line facilities; send and receive; address books, synchronisation, message rules,

messenger services, newsgroups and accounts.

8 Printing, eg printer selection; printer properties; printer set up, eg paper size, paper type, scaling, orientation, etc; print preview; use of print preview facilities, eg zoom, multiple pages, ruler, scaling, etc.

9 Searching should involve several criteria, eg key terms or fields, and requires decisions to be made about an effective strategy for their application, eg with due regard for time, cost, effective filtering and result.

10 Extracting and presenting relevant information - relevant data may be records in a database, a photographic image, a video or audio clip. Selection/importation may involve tools such as screen grabbers, digital or video cameras and scanners.

This unit is designed to enable students to use IT systems and applications independently to support a range of information processing activities. The unit is designed to develop a knowledge of the theoretical concepts, principles, boundaries and scope of IT applications. These activities will be centred on using several software application packages to meet complex information requirements.

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 7

Instrument of assessment

There are two Outcomes, both largely of a practical nature.

Outcome 1: Prove Knowledge and/or Skills of: the different components of a computer system, the function of tools such as file manager, print manager and control panel, the ways in which data can be kept secure and the causes of common software and hardware problems and how to resolve them.

Outcome 2: Uses a range of software application packages, (at least four) to meet complex information requirements. The learners will be given a comprehensive checklist of all evidence required to successfully complete this Outcome. They will then have to create a technical manual and player guide indicating on the checklist exactly where each

requirement has been met. Given the complexity of the technical manuals and user guides shipped with today's games, this should make for a demanding, but hopefully enjoyable experience.

Guidance on approaches to delivery of this Unit

This unit is designed to enable learners to use IT systems independently to support a range of information processing activities. Early inclusion of this unit in the Group Award is preferable as students should then be able to present work for other Units using the skills learned in this unit.

During the course of the unit learners should have several opportunities to develop their practical skills and should then be assessed appropriately.

Assessment should be by one project or case study. Candidates should have access to on-line help, tutorial support and/or suppliers' manuals as required.

Individual centres will need to plan Outcome 2 to ensure that such resources as the internet service provider, compact discs, available telephone lines, modems, software application packages and operating systems updates are available prior to commencement of the unit.

If this unit is being delivered as part of a Professional Development Award which receives endorsement from a vendor such as Microsoft, it must be delivered and evidence generated as detailed in the document 'Approval to certification' which is associated with that particular vendor and the Professional Development Award.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Outcome 2

The emphasis in this Outcome should be on producing complex information in a context which is unfamiliar to the learner. Centres may wish to complete an observation checklist to keep track of the learner's development in the use of the four chosen software applications

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 8

packages. The software application packages chosen must be relevant to the vocational area of the Group Award undertaken by the learner.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

This unit gives automatic certification of the core skill: Using Information Technology at SCQF level 6.

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 9

Administrative information

History of changes to Unit

Version Description of change Date

acknowledged.

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification

HP6L 47, Information Technology: Applications Software 1 (SCQF level 7) 10

General information for learners

Unit title: Information Technology: Applications Software 1

(SCQF level 7)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

This unit is designed to enable you to use IT systems and applications independently to support a range of information processing activities. You should develop a broad knowledge of the theoretical concepts, principles, boundaries and scope of IT applications. By the end of the unit you should have learned how to plan for, develop and produce the relevant information requirements of users.

To meet the requirements of users you will be required to use and develop a broad range of skills in a range of software applications packages, (a minimum of four), such as, word processor, spreadsheet, database, simulation, graphics, communications, (ie internet, intranet, email, etc), audio/music, animation, video, multimedia, desktop publishing, data logging and retrieval, control or other packages.

On successful completion of the unit you will be able to:

1 Operate a range of IT equipment independently, giving attention to security and to other users.

2 Use a range of software packages to meet complex information requirements.

In Outcome 1 you will learn about the components of hardware, the functions of operating system tools and how these are used. You will also learn about data security measures and resolving common hardware and software problems. You will learn about all of the elements above in the context of meeting the needs of all users of a computer system.

In Outcome 2 you will learn about how to use a range of software packages to meet complex information requirements. You will learn about a minimum of four different software packages from the whole range of applications packages available. The emphasis in this Outcome will be on producing complex information in a context that is unfamiliar to you. You will learn how to integrate data types, (eg text, number, graphics, audio, video) into a single product and to format the product so that the final output is clear and helpful to users. You will find out how to: plan to meet users' information requirements; select software packages appropriate to information requirements; select suitable computer data sources for information and extract suitable information from these computer data sources to meet relevant user requirements.

To complete this unit successfully, you must demonstrate a satisfactory level of performance in a number of tasks covering the Outcomes listed above. You must provide evidence of the work you carry out for each assessment task in the form of a set of printed documents with a front cover: each print having details of your name, the date and the task. You will be encouraged to access on-line help facilities, tutorial support and/or suppliers' manuals as required.

More detailed guidance on the content, amount, style and quality required of your work will be made available to you during your progress through the unit. Your assessor will observe you carrying out the assessment tasks, and will complete an observation checklist to certify that each of your prints is your own work and whether or not it has reached the required standard.Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 1

SQA Advanced Unit Specification

General information for centres

Unit title: Inspection and Testing of Low Voltage Electrical Installations

Unit code: HV2L 47

Unit purpose: The purpose of this Unit is to enable candidates to demonstrate knowledge,

understanding and competence in testing and inspection of electrical installations.

On completion of the Unit the candidate should be able to:

1. Explain the general requirements for the inspection and testing of an electrical installation

during its normal life-cycle.

2. Explain the recommended tests to verify the integrity of an electrical installation.

3. Explain the requirements and precautions for testing electrical installations.

4. Carry out appropriate testing procedures which conform to British Standard requirements.

Credit points and level: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level

7*)

*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications

Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an

SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.

Recommended prior knowledge and skills: Candidates should possess a general

knowledge and understanding of electrical principles and electrical installation. This may be

evidenced by the possession of the SQA Advanced Unit, HP46 47 DC and AC Principles. A

knowledge of the requirements of the current edition of the IEE Wiring Regulations (BS7671) would

be beneficial. However, entry requirements are at the discretion of the centre.

Core skills: There may be opportunities to gather evidence towards the following listed Core

Skills or Core Skills components in this Unit, although there is no automatic certification of Core

Skills or Core Skills components:

¨ Written Communication (reading) at SCQF level 6

¨ Written Communication (writing) at SCQF level 5

¨ Critical Thinking at SCQF level 6

¨ Planning and Organising at SCQF level 5

¨ Reviewing and Evaluating at SCQF level 5

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 2

Context for delivery:. This Unit was developed for the SQA Advanced Certificate and SQA

Advanced Diploma in Electrical Engineering awards. If this Unit is delivered as part of another

group award, it is recommended that it should be taught and assessed within the subject area of the

group awards to which it contributes.

Assessment: The assessment for Outcomes 1, 2 and 3 of this Unit should be combined together

into one written assessment paper. This paper should be taken by candidates at one single assessment

event that should last one and a half hours. The assessment paper should be composed of a suitable

balance of short answer, restricted response and structured questions. This assessment should be

conducted under controlled, supervised conditions

Outcome 4 will be assessed by practical exercises, the evidence being recorded using an observation

checklist, the production of a short report and the completion of standard test result sheets and an

inspection report during the testing procedures. The completion of documentation is extremely

important in this Unit and all assessments should be based on the IEE Certificates for Inspection,

Testing and Certification of Electrical Systems. These practical exercises should incorporate both a

visual inspection of an electrical installation, lasting 30 minutes and a series of installation tests along

with the completion of the required certification. The testing and certification section of the exercise

should last 60 minutes.

NOTE: the electrical installation should contain a minimum of two faults which must be found during

the testing exercise.

The first assessment (Outcomes 1, 2 and 3) should be carried out after delivery of Outcome 3 and the

second assessment (Outcome 4) should be carried out at the end of the delivery of this Unit.

It should be noted that candidates must achieve all the minimum evidence specified for each Outcome

in order to successfully achieve the Unit.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 3

SQA Advanced Unit Specification: statement of standards

Unit title: Inspection and Testing of Low Voltage Electrical Installations

Unit code: HV2L 47

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements

are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the

knowledge and/or skills section must be taught and available for assessment. Candidates should not

know in advance the items on which they will be assessed and different items should be sampled on

each assessment occasion.

Outcome 1

Explain the general requirements for the inspection and testing of an electrical installation during its

normal life-cycle.

Knowledge and/or skills

¨ Methods of initial inspection

¨ Recommended sequence of initial tests to be carried out

¨ Reason for periodic inspection and testing

¨ Procedures to be adopted for alterations and additions to an installation

Outcome 2

Explain the recommended tests to verify the integrity of an electrical installation.

Knowledge and/or skills

¨ Procedures for testing electrical installations

¨ The need to measure the maximum prospective fault current and external earth fault loop

impedance at the point of origin of the installation.

Outcome 3

Explain the requirements and precautions for testing electrical installations.

Knowledge and/or skills

¨ The reasons for permit-to-work and sanction-for-test documents being required in certain work

environments.

¨ The reasons for intrinsically safe test instruments being required in potentially explosive

environments.

¨ The use of test instruments and precautions.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 4

Evidence requirements

Evidence for the knowledge and /or skills in Outcomes 1 to 3 will be provided on a sample basis. The

evidence may be presented in responses to specific questions. Each candidate will need to

demonstrate that she/he can answer correctly questions based on a sample of the items shown under

the knowledge and skills items in all three Outcomes. In any assessment of the Outcomes three out

of four knowledge and/or skills items should be sampled from Outcome 1, two out of two

knowledge and skills items from Outcome 2 and two out of three knowledge and skills items for

Outcome 3.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a

different sample of three out of four knowledge and/or skills items from Outcome 1, and two out of

three knowledge and skills items from Outcome 3 are required each time the Unit is assessed.

Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence

provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

Outcome 1

¨ Explain the methods of initial inspection

¨ List the recommended sequence of initial tests to be carried out

¨ Describe the reason for periodic inspection and testing

¨ Explain the procedures to be adopted for alterations and additions to an installation

Outcome 2

¨ Describe the procedures for testing electrical installations

¨ Explain the need to measure the maximum prospective fault current and external earth fault loop

impedance at the point of origin of the installation.

Outcome 3

¨ Explain why in certain work environments permit-to-work and sanction-for-test documents are

required.

¨ Explain why in potentially explosive environments intrinsically safe test instruments are required.

¨ Explain the use of test instruments and precautions.

Evidence should be generated through assessment undertaken in controlled, supervised conditions.

Assessment should be conducted under closed book conditions and as such candidates should not be

allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be provided

with current codes of practice, BS7671 or other relevant legislative documentation for use during the

assessment.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 5

Assessment guidelines

The assessment for Outcomes 1 to 3 should be combined together to form one assessment paper. This

single assessment paper should be taken at a single assessment event lasting one and a half hours and

carried out under supervised, controlled conditions. Such a paper should be composed of an

appropriate balance of short answer, restricted response and structured questions. This assessment

should be taken after delivery of Outcome 3.

Outcome 4

Carry out appropriate testing procedures which conform to British Standard.

Knowledge and/or skills

¨ Technical data requirements to enable testing and inspection to take place correctly.

¨ Safe isolation procedure on a simulated electrical installation

¨ Visual inspection of an electrical installation

¨ Testing of an electrical installation

¨ Schedules of testing results and a periodic inspection report

Evidence requirements

Evidence for the knowledge and/or skills in Outcome 4 will be provided by the candidate carrying out

a visual inspection and a series of tests on a simulated electrical installation and completing the

required documentation.

This exercise is intended to be undertaken on a simulated installation operating at a safe level of

working voltage.

The simulated installation rig(s) should be supplied from a three-phase isolator and feed a single-

phase distribution board from which lighting circuits and power circuits are supplied. A three phase

motor circuit should be provided for. A residual current device or devices should be included in the

design. The design of the rig(s) is not critical but must be such that all the tests can be performed

effectively. Different rigs can be used to cover the complete range of tests.

Candidates will be required to carryout the following tests in the sequence prescribed in BS 7671

Part 7:

¨ Continuity of protective conductors including main and supplementary equipotential bonding

¨ Continuity of ring final circuit conductors

¨ Insulation resistance

¨ Polarity

¨ Earth electrode resistance

¨ Earth fault loop impedance

¨ Prospective fault current

¨ Residual Current Device (RCD) testing

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 6

A total of TWO fault conditions will be built into the test circuits to verify the candidate's ability to

interpret the test results obtained. The candidate will be expected to identify the fault results and

highlight these in his/her inspection report.

Observation checklists should be used to record the candidate's performance for the inspection and

each of the testing procedures.

The candidate should be given the necessary work instructions to carry out the inspection and testing.

A selection of the necessary hand tools and a range of test instruments should be provided.

During the tests, the candidate will be expected to record all relevant information and tests results for

all circuits on a standard test results sheet and to complete a periodic inspection report.

Safe working practice must be observed throughout the inspection and testing procedure.

Written evidence should be produced to show the candidate's ability to explain the technical data

requirements to enable testing and inspection to take place and to outline the safe isolation procedure

which will be implemented prior to the testing procedures taking place.

A candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet

the requirements for each item by showing that the candidate is able to:

¨ Explain the technical data requirements to enable testing and inspection to take place correctly.

¨ Demonstrate a safe isolation procedure on a simulated electrical installation.

¨ Perform an inspection of the simulated electrical installation

¨ Perform the listed tests on a simulated electrical installation

¨ Complete the schedules of testing results and a periodic inspection report

Evidence should be generated through assessment under controlled, supervised conditions.

Assessment should be conducted under closed-book conditions and, as such, candidates must not be

allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be provided

with current codes of practice, BS7671 or other relevant legislative documentation for use during the

assessment.

Assessment guidelines

Outcome 4 should be assessed by practical testing exercises on a simulated electrical installation

rig(s).

Evidence of the candidate's ability to carry out the inspection and testing procedures should be

recorded using observation checklists.

The candidate will also be required to complete the standard test result sheet and an inspection report

which should include identification of the two fault condition results.

A report, of approximately 400 words plus diagrams, charts etc, along with completion of a 'Periodic

Inspection Report for and Electrical Installation'

(Appendix 6, BS7671), should be produced by the candidate to show his/her ability to explain the

technical data requirements to enable testing and inspection to take place and to outline the safe

isolation procedure which will be implemented prior to the testing procedures taking place.

The assessment of the Outcome 4 should be undertaken at the end of the Unit.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 7

Administrative Information

Unit code: HV2L 47

Unit title: Inspection and Testing of Low Voltage Electrical Installations

Superclass category: TH

Date of publication: November 2017

Version: 01

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development

of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or

0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 8

SQA Advanced Unit Specification: support notes

Unit title: Inspection and Testing of Low Voltage Electrical Installations

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length

is 40 hours.

Guidance on the content and context for this Unit

This Unit has been written in order to allow candidates to develop their knowledge and competence

in the following areas:

1. General requirements for the inspection and testing of an electrical installation

during its normal life-cycle.

2. Recommended tests to verify the integrity of an electrical installation.

3. Requirements and precautions for testing electrical installations

4. Testing procedures which conform to British Standard requirements

In designing this Unit, the unit writer has identified the range of topics expected to be covered by

lecturers. The writer has also given recommendations as to how much time should be spent on each

Outcome. This has been done to help lecturers decide what depth of treatment should be given to the

topics attached to each of the Outcomes. Whilst it is not mandatory for centres to use this list of

topics, it is recommended that they do so since the assessment exemplar pack for this Unit is based on

the knowledge and/or skills and list of topics in each of the Outcomes.

A list of topics for each Outcome is given below. Lecturers are advised to study this list in

conjunction with the assessment exemplar pack so that they can get a clear indication of the standard

of achievement expected of candidates in this Unit

1 Explain the general requirements for the inspection and testing of an electrical

installation during its normal life-cycle. (10 hrs)

This Outcome should provide candidate with an understanding of the general requirements for

inspection and testing of an electrical installation when it is newly installed, the periodicity of re-

inspecting and testing and the action that should be taken if alterations or additions are made. The

requirements of part seven of BS7671 provided the technical foundation for developing the subject

and the IEE guidance notes on Inspection and Testing (ISBN 0-85296-991-0) develop the regulations.

¨ Safety

¨ Required competence

¨ The Client

¨ Record keeping

¨ Purpose of initial verification

¨ Frequency of subsequent installations

¨ Initial inspection

Consideration should also be given to the following:

Electrical installation: TN-S; TN-C-S; TT. Nominal voltage 230V and 400V; rating of over current

protective devices at the origin of the installation not to exceed 100A; work environment is domestic;

commercial and light industrial.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 9

Initial Inspection: connection and identification of conductors; cable routing; current carrying

capacity; voltage drop; connection of control devices; connection of accessories; equipment; fire

barriers; methods of protection against electric shock; labelling, presence of notices; erection

methods; presence of under-voltage protection; adequate access to switchgear and equipment;

protection methods for direct and indirect contact; adequate earthing arrangements; selection of

equipment and protective measures appropriate to external influences; position of devices for

isolation and switching location.

Reasons for periodic testing and inspection; legislative requirements; verification of continued

compliance with BS7671; change of ownership or tenancy of premises; alterations or additions to

existing installation to change electrical loading.

2 Explain the recommended tests to verify the integrity of an electrical installation (10 hrs)

This Outcome should provide the candidate with an understanding of why the tests are being carried

out; the requirements that have to be met to satisfy part seven of BS7671 and the methods of tests that

are to be performed.

The Outcome should provide candidates with an understanding of why it is necessary to know the

value of the prospective short circuit current and the external earth loop impedance and also provide

an explanation of how to approach the measurement of these.

¨ Purpose of periodic inspection and testing

¨ Necessity for periodic inspection and testing

¨ Initial testing

Electrical installation: TN-S; TN-C-S; T.T. Systems

Tests: Continuity of protective conductors main and supplementary bonding, continuity of ring final

circuit conductors; insulation resistance; polarity tests; earth electrode resistance; earth fault loop

impedance; operation of residual current devices; measurement of characteristics of supply at the

origin of the circuit.

3 Explain the requirements and precautions for testing electrical installations (10 hrs)

This Outcome should provide the candidate with an understanding of why safety documentation is

essential before work is carried out in organisations that specify permits-to-work and sanction-to-test

documents as part of their safety policy. The responsibility of the electrical contractor to comply

with safety procedures and the delegation of authorised signatories by the company to the contractor,

for safety documents, should be discussed. The need to recognise that intrinsically safe instruments

are required in installations designated as hazardous should be emphasised. Reference only is

required to the zoning of areas and the types of environment where more specialist testing

consideration is necessary.

Relevant requirements of the Health and Safety at Work Act and the Electricity at Work Regulations

in an industrial environment, where additional hazards may be present, permits-to-work and

sanctions-for-test.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 10

Requirements: instrument accuracy; field and instrument errors; routine calibration and checking of

low resistance ohmmeter; insulation resistance ohmmeter; applied voltage tester; earth fault loop

impedance testers; earth electrode, test sets; RCD Testers.

4 Carry out appropriate testing procedures which conform to British Standard

requirements (10 hrs)

This Outcome should provide the candidate with the opportunity to prepare for inspection and testing

and carry out inspection and testing.

The centre will require a simulated test rig(s) to enable the tests specified in the range statement to be

carried out effectively. It is recommended that the rig(s) should be supplied from a three-phase

isolator and feed a single-phase distribution board from which lighting circuits and power circuits are

supplied. A three phase motor circuit should be provided for. A residual current device or devices

should be included in the design. The design of the rig or rigs is not critical providing all the tests

can be performed effectively. Different rigs can be used to cover the complete range of tests.

Observation checklists are required for each of the tests. The candidate should be given the

necessary work instructions to carry out the testing. A selection of the necessary hand tools and a

range of test instruments should be provided. During the test the candidate will be expected to record

all relevant information and tests results for all circuits on an appropriate results sheets; safe working

practice must be observed throughout the inspection and testing procedure.

Technical data: available diagrams; charts; previous test results for inspection; test

certificates; general characteristics of installation; access to design data (new installation).

Isolation procedure: isolate; lock off; issue permit-to-work; complete permit documentation; test for

dead.

Test of external earth loop impedance and prospective short circuit current (PSCC); protective

conductors continuity: continuity of ring final circuit conductors; insulation resistance; polarity;

Earth fault loop impedance; earth electrode resistance; operation of residual current devices

A candidate-centred learning approach is recommended. Underpinning theory should be reinforced

by use of short testing exercises where a hands-on-approach should be encouraged. Throughout the

Unit the importance of accurate documentation should be stressed. Safety procedures and practices

should be observed at every stage of the unit.

Guidance on the delivery and assessment of this Unit

The purpose of this Unit is to enable candidates to demonstrate knowledge, understanding and

competence in the testing and inspection of electrical installations.

The Unit is aimed at those with previous electrical installation knowledge and some knowledge of

BS7671.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 11

This Unit was developed within the Options section of the SQA Advanced Certificate and SQA

Advanced Diploma in Electrical Engineering awards. It should be seen as being complementary to

the SQA Advanced Units Electricity Power Systems, Electrical Safety, Electrical Installation Skills

and Electrical Installation Design.

Details on approaches to assessment are given under Evidence requirements and Assessment

guidelines under each Outcome in the SQA Advanced Unit Specification: statement of standards

section. It is recommended that these sections be read carefully before proceeding with assessment of

candidates.

Open learning

This Unit may be delivered by distance learning however, due to the practical nature of Outcome 4, a

considerable degree of centre support will be required. With regard to assessment, planning would be

required by the centre to ensure the sufficiency and authenticity of candidate evidence. Arrangements

would be required to be put in place to ensure that the assessments were conducted under controlled,

supervised conditions.

For information on normal open learning arrangements, please refer to the SQA guide

Assessment and Quality Assurance of Open and Distance Learning (SQA 2000)

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning

or assessment. The individual needs of learners should be taken into account when planning learning

experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification

Unit (HV2L 47): Inspection and Testing of Low Voltage Electrical Installations 12

General information for candidates

Unit title: Inspection and Testing of Low Voltage Electrical Installations

This Unit has been designed to allow you to gain knowledge of the requirements of the16th Edition

Wiring regulations (BS7671) inspection and testing techniques and of the test instruments required to

carry out these tests. You will gain the opportunity to practice using these instruments and evaluating

the test readings taken. In addition, you will be instructed on the mandatory and general requirements

for inspection and testing of electrical installations.

You will be supported in developing an understanding of the following topics:

¨ General requirements for inspection and testing of an electrical installation.

¨ Periodicity of re-inspection and testing

¨ Actions to be taken when alterations or additions are made to an electrical installation

¨ Reason for testing

¨ How to perform tests as detailed in BS7671

¨ Test to be performed

¨ Continuity of protective conductors

¨ Continuity of ring circuit conductors

¨ Polarity

¨ Insulation resistance

¨ Earth loop impedance

¨ Prospective fault current

¨ RCD Test

¨ Safety documentation (permits-to-work)

¨ Why use calibrated instruments

¨ Use of standard test certificates as per Appendix 6 of BS 7671

This Unit is predominantly practical with a strong emphasis on understanding why and how to inspect and test low voltage electrical installations.HV2W 47, Electrical Design Systems: An Introduction (SCQF level 7) 1

SQA Advanced Unit Specification: general information

Unit title: Electrical Design Systems: An Introduction

Unit code: HV2W 47

Superclass: XJ

Publication date: November 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit has been designed to allow candidates to develop their knowledge, understanding and skills of a range of services provided by the distribution of power and network communication cabling throughout an electrical installation. More specifically candidates will

study earthing systems and how protection from touch voltages is achieved. This Unit also introduces candidates to the design procedures involved in selecting conductors to supply single and three-phase equipment located in small modern electrical distribution systems.

On completion of the Unit the candidate should be able to:

1 Examine the principles of protective earthing systems.

2 Apply electrical design procedures when selecting current carrying conductors.

3 Investigate structured distribution data cable systems for communication networks.

Recommended prior knowledge and skills

Entry to this Unit is at the discretion of the centre, however candidates should have a basic knowledge and understanding of electrical systems, equipment and protective devices, or have technical experience of electrical systems within building services. This may be evidenced by possession of Electrical Installation Units from the National Certificate(s) in Electrical Engineering.

HV2W 47, Electrical Design Systems: An Introduction (SCQF level 7) 2

Credit points and level

1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment

The assessment for this Unit is in two parts.

An assessment lasting one and a half hours, which should be conducted under controlled supervised conditions and should follow after the delivery of Outcomes 1 and 2.

An investigation should be completed for the design specification of standard network cabling for voice and data communication systems for a small modern building. Candidates will be expected to produce a report of between 1,000–1,200 words or equivalent that includes diagrams and appendices on the specification for the network system.

Teaching and learning and assessments do not have to be presented to the candidates in any specific order.

HV2W 47, Electrical Design Systems: An Introduction (SCQF level 7) 3

SQA Advanced Unit Specification: statement of standards

Unit title: Electrical Design Systems: An Introduction

Unit code: HV2W 47

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Outcomes are assessed. Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidates response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to: summarised below. Centres are advised to check SQA's APS Navigator to confirm they are

using the up to date qualification structure.

NOTE: Where a Unit is revised by another Unit:

¨ No new centres may be approved to offer the Unit which has been revised.

¨ Centres should only enter candidates for the Unit which has been revised where they are expected to complete the Unit before its finish date.

Version

number Description Date

15 Addition of Unit: FY7L 35 Electrical Installation Design added

to the optional section of the HNC framework

01/05/24

14 Addition of Units: J0HA 34 Computer Programming and J0H9

34 Data Security added as Optional units to HNC and HND

frameworks

29/03/19

13 Revision of Unit: DE1K 33 Workplace Communication in English

has been revised by H8T2 33 and finishes on 31/07/2016.

08/05/15

12 Removal of finish date from unit DG4P 35 Mathematics for

Engineering 3. Addition of Credit Transfer Table see Pages 39 and

40.

15/01/15

11 Revision of Units: D77G 34 Communication: Practical Skills revised

by H7MB 34. DG4H 33 Mathematics for Engineering 1: Electronics

and Electrical revised by H7K0 33 Engineering Mathematics 1.

DG4L 34 Mathematics for Engineering 2 revised by H7K1 34

Engineering Mathematics 2 on HNC and HND frameworks finishing

31/07/2016.

21/10/14

10 Engineering Mathematics 3 (H7K2 34), Engineering Mathematics 4

(H7K3 35) and Engineering Mathematics 5 (H7K4 35) added as

optional Units to HND framework.

19/08/14

09 Project Management: An Introduction (A6AX 34) added as an

optional Unit to HND framework.

15/08/14

08 Addition of optional Units: Energy Overview (H4J5 34) and Energy

Technologies (H4J6 35).

09/08/13

07 Due to the HN Review the following Units have been amended and

recoded: DN4F 35, DN48 33, DN4L 34, DN4J 34, DN42 34, DG2X

34 and DG54 34.

26/04/12

06 Optional section of framework on page 17 updated to include three

missed Units.

18/10/11

05 Credit transfer amended on Communication Unit from full to partial. January

2011

04 Units added to HND within optional area of the framework to give

direct articulation in to year 3 of Robert Gordon's University BEng

Course.

December

2009

03 Broadening and other Units added to HNC and HND. November

2007

Contents

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 1

1 Introduction

This Arrangements Document has been written in order to assist centres in

preparing for approval of the new HNC and HND Electrical Engineering awards and maintaining the awards thereafter. These two awards were developed under the new SQA Design Principles, were validated in March2005, and replace the existing HNC Engineering: Electrical and the HND Engineering: Electrical.

This Document includes details on the background to the development of the new awards, their aims (both general and specific), recommended access requirements, information about the structure of the awards, recommendations on delivery and assessment and other guidance for centres.

2 Rationale for the Revisions of the Awards

2.1 Electrical Engineering

The term Electrical Engineering in the context of this document covers the range of subjects traditionally included in SQA Higher Nationals in Electrical Engineering, namely power, plant and electrical installation. The title Electrical Engineering is intended to provide candidates, lecturers, Higher Education, employers and professional bodies with a clear, unambiguous title.

Electronics has not been included in the HNC and HND Electrical Engineering titles as only sufficient electronics has been included in both awards to underpin studies in the various branches of electrical engineering.

2.2 HN Engineering Frameworks

In 1996 the SQA validated nationally a large number of new HN Engineering awards including two awards entitled HNC Engineering: Electrical and HND Engineering: Electrical. A major difference between these and previous awards were that they all sat within an HN Engineering Framework which in general terms consisted, for both HNCs and HNDs, of a common core of Units (Units common to all HNC and HND Engineering awards), a principles/technology and optional sections. The benefits of this Framework structure were seen to include the following:

¨ provide a wide range of HN Engineering qualifications to meet the needs of different engineering sectors

¨ improve the credibility and esteem of individual HN Engineering awards

¨ clarify those competencies that were general to all incorporated engineers and those that were specific to particular engineering disciplines

¨ provide opportunities for the efficient delivery of HN Engineering Units by, for example, incorporating Units that were common to a number of different HN awards

¨ facilitate better progression between HNC, HND and Degree engineering awards

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 2

Prior to the development of any HN Engineering awards a major consultation exercise was undertaken on the overarching HN Engineering Framework to test the validity of the Framework. This consultation comprised of the following five strands:

¨ a questionnaire survey with stakeholders of HN Engineering awards

¨ a series of meetings with various interested stakeholders of HN Engineering awards

¨ desk based research

¨ discussions (followed by endorsement) of a proposed HN Engineering Framework at a HN Engineering Steering Group meeting

¨ a major consultation event with FE colleges on 24 May 2002 which included a questionnaire survey

The consultation revealed continuing strong support for an overarching HN Engineering Framework but with the following modifications:

¨ a reduction in the number of common core Units

¨ a strengthening of the Principles/Technology section with an even stronger

emphasis on the teaching of core engineering principles and technologies

Optional sections are retained in all HNC and HND Engineering awards.

The revised HNC and HND Engineering Frameworks are shown in block diagram

form in Figures 2.1 and 2.2. It should be noted that the PDAs shown in both

diagrams may be developed as more HN Units come on stream; currently none of

these PDAs exist.

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 3

HNC Engineering Framework

Figure 2.1

Communication: Practical Skills

1 credit Mandatory Unit

HNC

8 Principles/Technology credits

2 optional credits

Strong emphasis on core

principles/technologies

A limited degree of specialisation within

the engineering specialist area

Corresponding HND award in the

same engineering discipline area

Graded

Unit

Examination

1 credit

PDA

Specialist

Engineering

Areas

Team

Working &

Leadership

Supervisory

Skills

Information

Technology

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 4

HND Engineering Framework

Figure 2.2

Communication: Practical Skills

Information Technology: Applications Software 1

Business Awareness & CPD

3 credits of Mandatory Units

Corresponding HNC Engineering

award in the same Engineering

discipline area embedded as the first

year of the HND

HND

17* Principles/Technology credits

7 optional credits

More advanced engineering principles

High level of specialisation in engineering

specific subject areas(s)

*Includes the 8 Principles/Technology

credits in the HNC

HNC

Graded

Unit

Examination

1 credit

PDA

Specialist

Engineering

Areas

Team

Working &

Leadership

Supervisory

Skills

Information

Technology

2 Graded Units

HND

Engineering

Project

2 credits

HNC

Engineering

Examination

1 credit

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2.3 History and Market Research to support the HNC and HND

Electrical Engineering

2.3.1 History of the HNC and HND Electrical Engineering awards

The introduction of the SCOTVEC Advanced Courses Development Programme lead to the replacement of the 132 HND in Electrical and Electronic Engineering award by a competence based HND in Electronic and Electrical Engineering in 1989. Shortly after an HNC in Electronic and Electrical Engineering was introduced as part of a national development and replaced the 101 HNC in Electrical and Electronic Engineering. However, there continued to be little commonality between the new HNC and HND awards. The first attempt to harmonise the two awards took place as part of a consortium development in the early nineties. In 1995 and 1996 the two awards were totally harmonised (eg the HNC Electrical becoming effectively the first year of the HND) as part of a major SCOTVEC national development which saw the introduction of an overarching HN Engineering Framework. The two new awards represent a further development of Higher National Engineering awards taking full account the new HN Design Principles and providing an opportunity to update the awards in light of technological and educational developments.

2.3.2 Market Research

The development of the new HNC and HND Electrical Engineering awards included extensive market research which is summarised below in Table 2.3.

Stakeholder Method

All Major desk based research gathering and analysing data

from various sources (eg SEMTA, FutureSkills Scotland

etc.)

Delivery Centres Initial postal survey of all delivery centres followed by

two National seminars.

Draft Units, assessment exemplars and outlines of

graded Units were made available to centres.

Employers Surveys of employers were carried out at the

commencement of the development of the two awards

and when the two award structures and Units were

nearing finalisation. Information obtained from

employers helped to inform both structure and Unit

development

Higher Education Letters of support for articulation between the new HNC

and HND Electrical Engineering and Degree awards

were received from seven Higher Education institutions.

Professional Bodies The Chair of the Institute of Incorporated Engineers was

a member of the Validation Panel and provided a broad

measure of support for the two new developments at the

Validation Event which was later confirmed in writing.

Table 2.3

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 6

Stakeholder Method

Health and Safety

Executive

A representative from the Health and Safety Executive

provided some invaluable input into the development

of the Electrical Safety Unit and other Units with

significant safety content.

Students Whilst not consulted directly the student experience of

the current HNC and HND Engineering: Electrical

was taken fully into account in the new developments.

Table 2.3 (continued)

2.4 Candidates

2.4.1 HNC Candidates

Candidates at HNC level may already be in employment and will attend centres on a day-release or other part-time basis. The HNC framework structure is flexible enough to allow centres to deliver the HNC award by various modes of delivery for example, two-year day-release, evening attendance etc.

The options chosen by employed candidates may reflect the branch of industry in which they are employed or may be used to gain knowledge of other areas within electrical engineering in order to improve their career opportunities in the employment market. Part-time candidates may also use the HNC award to gain entry to Degree level studies.

Full-time HNC candidates may be school leavers intending to articulate to a University Degree Course, or candidates who wish to progress from an appropriate National Certificate qualification. Full-time candidates may also be more mature persons who are seeking a change of employment.

Since the HNC award forms an integral part of the HND award, full-time candidates will complete 15 Unit credits in the first year of the course, 12 of these meeting the HNC requirements. Full-time candidates will therefore have completed the first year of the HND programme and may, if they wish, continue to the second year of the HND award.

In addition to University entrance, successful full-time HNC candidates have enhanced their prospects of gaining employment in the Electrical Engineering

industry.

2.4.2 HND Candidates

The HND award programme will normally be delivered on a two-year full-time basis, although this does not preclude other delivery patterns. This being the case, HND candidates may be school leavers who have an interest in some aspect of electrical engineering and wish to include this in their career path. This may be candidates who wish to progress from an appropriate National Certificate qualification or candidates who have previously completed the HNC award and wish to progress to the HND. The typical HND candidate will therefore be a young person intending to articulate to a University Degree Course. The Units of the

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 7

HNC/D framework have been designed to introduce candidates to electrical engineering and to take topics to a more advanced level than is possible in the HNC. Mature candidates may also embark on the HND programme. The HN Electrical Development Team and Unit writers were aware that such candidates may not have studied for some time and will require additional support in developing their learning skills. The HN Electrical Units have been designed as far as possible to provide candidates with opportunities to develop critical knowledge and understanding of theory and practical hands-on skills required by practising electrical incorporated engineers.

3 Aims of the Awards

3.1 General Aims of the HNC Electrical Engineering

The general aims of this award are to:

3.1.1 enhance candidates' employment prospects

3.1.2 support candidates' Continuing Professional Development and career development

3.1.3 enable progression within the SCQF (Scottish Credit and Qualifications Framework)

3.1.4 develop candidates' ability to apply analysis and synthesis skills to the solution of electrical engineering problems

3.1.5 develop learning and transferable skills (including Core Skills).

3.2 Specific Aims of the HNC Electrical Engineering

The specific aims of this award are to:

3.2.1 provide an award that will allow candidates to work now, or in the future, as electrical technicians or incorporated electrical engineers

3.2.2 provide an award that creates a route towards meeting the academic requirements for Incorporated Engineer status

3.2.3 develop an award that on successful completion will allow candidates to progress to HND Electrical Engineering and/or a Degree in Electrical Engineering or related subject discipline area

The development of this new HNC award will also allow candidates to:

3.2.4 develop a range of Communication knowledge and skills relevant to the needs of electrical incorporated engineers

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 8

3.2.5 develop knowledge, understanding and skills in a range of core electrical principles, electrical power systems, electrical machine principles and electrical safety at Higher National level (these studies in core electrical principles and technologies are underpinned by a mandatory Unit in Mathematics)

3.2.6 develop knowledge and skills in the use of electrical and electronic instruments

3.2.7 achieve a degree of specialisation within the following areas: Electrical

Principles, Information Technology, Three Phase Induction Motors, Power Electronics, Inspection and Testing of Low Voltage Electrical Installations, Programmable Logic Controllers, Electrical Systems in Hazardous Environments, Control Systems, further Mathematical studies, Electrical Installation Skills and Engineering Quality

3.2.8 on successful completion of the award, achieve the Core Skill Communication at Higher level and the component Using Number of the Core Skill Numeracy at Higher level. The candidate will also be provided with opportunities to develop the following Core Skills: Information Technology at Higher level, the component Using Graphical Information of the Core Skill Numeracy at Higher level, Problem Solving at Higher level and Working with Others at Intermediate 1 level.

3.3 General Aims of the HND Electrical Engineering

The same as for the HNC Electrical Engineering award but with the addition of the following:

3.3.1 develop candidates' knowledge and skills in planning and project management

3.3.2 develop investigation skills

3.4 Specific Aims of the HND Electrical Engineering

The same as for the HNC Electrical Engineering but with the addition of the following:

3.4.1 develop an award that on successful completion will allow candidates' to progress to a Degree in Electrical Engineering or related subject discipline area.

The development of this new HND award will also allow candidates to:

3.4.2 develop knowledge and understanding of the external and internal factors that influence the performance of modern companies

3.4.3 recognise the important role Continuing Professional Development plays in career development

3.4.4 expand on the range of knowledge, understanding and skills in core electrical principles, electrical machines and systems and electrical installation

3.4.5 allow for further specialisation within the following subject areas: Inspection and Testing of Low Voltage Installations, Programmable Logic Controllers, Electrical Systems in Hazardous Environments, Analogue and Digital Electronics, Quality Management, Electrical Installation Skills, Industrial Plant Maintenance, Synchronous Machines, Electrical Motor Drive Systems, Three Phase Induction Motors, High Level Engineering Software, additional Control Systems studies, Power Supply Circuits, Switchgear and Protection, Standby Systems, Electrical Installation Design: Computer Aided, advanced Mathematical studies and Employment Experience

3.4.6 on successful completion of the award, achieve the Core Skills in Communication at Higher level, Information Technology at Higher level, Problem Solving at Higher level and the Using Number component of the Core Skill Numeracy at Higher level. Candidates will be provided with opportunities to develop the Core Skill Using Graphical Information component of the Numeracy Core Skill at Higher level and the Working with Others Core Skills at Intermediate 1 level.

3.5 How the General Aims are met in the HNC and HND Award Structures and Content

Aim No How it is met in HNC and HND

3.1.1 For many years HNC and HND Electrical Engineering qualifications have equipped candidates to seek employment in a wide

range of manufacturing, service and public sector organisations. Market research indicates that HNC and HND Electrical

Engineering awards are still regarded as the minimum qualifications required by many organisations to work at electrical

technician or incorporated engineer level.

3.1.2 There has been a long tradition of candidates in employment taking HNC Electrical and Electronic awards on a part-time basis to

increase their knowledge of Electrical and Electronic Engineering and enhance their career development. In recent years, with

increased commonality between HNC and HND Electrical Engineering awards and greater flexibility in the way these awards are

delivered, candidates in employment have increasingly taken HNDs on a part-time basis to expand their knowledge and skills in

Electrical and Electronic Engineering and improve their career prospects. The two new awards contain a balance of core

principles and up to date knowledge and skills in Electrical Engineering which lends themselves to the Continuous Professional

Development and career development of candidates working at electrical technician and incorporated engineer levels.

Furthermore, the award structures have been designed to allow for easy progression between HNC and HND awards.

3.1.3 All Units within the new HNC and HND Electrical Engineering awards have been levelled at SCQF levels 6, 7 or 8. The two new

awards also conform to the SQA levelling requirements for HNC and HND awards. Thus, successful completion of one or both

awards will allow progression within the SCQF.

3.1.4 The nature of Electrical Engineering as a discipline lends itself to both the analysis and synthesis of problems. For example, when

a complex electrical and electronic system is analysed (using, say, a block diagram approach) by breaking it down into separate

functional parts or alternatively the synthesis of a complex system from simpler electrical and electronic systems. The two new

awards allow these important skills to be developed further both in the technical subjects and in the core Communication,

Information Technology ands Business Awareness and Continuing Professional Development Units.

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 11

Aim No How it is met in HNC and HND

3.1.5 The new HNC and HND Electrical Engineering awards provide centres with an opportunity to enhance learning skills not least by

creating opportunities for candidates to combine theory and practice to achieve a real understanding of a subject. For example,

some Units recommend significant use of practical work and/or computer simulation to reinforce learning. It is also anticipated

that centres will use innovative delivery approaches that may make use of sophisticated electrical and electronic laboratory

equipment and/or on-line delivery and/or Virtual Learning Environments to enhance candidate learning.

By their very nature Engineering courses require the transfer of technical knowledge and skills form one area to another. For

example, a significant level of Electrical Principles and Mathematics has been included in both HNC and HND Electrical

Engineering awards because these subjects provide underpinning knowledge, understanding and skills which are used elsewhere

in both awards. Candidates will also have an opportunity to use the Communication and Information Technology knowledge and

skills developed in the mandatory core Units in other parts of the awards to support such activities as report writing, presentation

and the application of specialist software packages. Core skills in general, and problem solving in particular, have been regarded

as very important by the HN Electrical Development Team since it is recognised that a good level of competence in these is

essential in the work of an incorporated electrical technician.

3.3.1 The double credit (16 SCQF points) Engineering Project Graded Unit in the HND Electrical Engineering award provides

opportunities for candidates to develop both their planning and project management knowledge and skills.

3.3.2 The Business Awareness and Continuing Professional Development Unit provides candidates with the opportunities to develop

their investigative skills by exploring the external and internal factors that affect the performance of a modern company and the

different ways that people learn. The Engineering Project also requires candidates to undertake some investigations into the

background to and a range of solutions for their engineering project.

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical Engineering (G7TC 16) 12

3.6 How the Specific Aims are met in the HNC and HND Award Structures and Content

Aim No How it is met in HNC and HND

3.2.1 An HNC and HND Electrical Engineering award has been recognised for many years by employers and other stakeholders of

these awards as appropriate qualifications for persons wishing to work at electrical technician or senior technician levels. Market

research indicates that there is a growing demand for people with technician level skills in electrical and electronic engineering

especially as companies automate a lot more of their processes. Thus, it is confidently anticipated that those achieving the HNC

and HND Electrical Engineering awards will find employment as electrical technicians and incorporated electrical engineers in a

wide range of small, medium and large companies.

3.2.2

&

3.2.3

An HNC or HND no longer satisfies fully the academic requirements for Incorporated Engineer status although these

qualifications continue to completely satisfy Engineering Technician requirements. The minimum qualification for Incorporated

Engineer is an ordinary Degree.

Given the clear progression routes that have been established between existing HNC and HND Electrical Engineering awards and

Degree courses by many FE colleges and universities, it is strongly anticipated that similar progression routes will also be

developed between the new HNC and HND Electrical Engineering awards and Degree courses. Thus, HNC and HND Electrical

Engineering awards will continue to form very important 'stepping stones' towards candidates achieving Degrees (and, thus,

satisfy fully the academic requirements for Incorporated Engineer status). Progression arrangements between HNCs, HNDs and

Degrees can only be strengthened with the full implementation of the SCQF. Seven letters have been received from Scottish

Universities confirming articulation arrangements between the new HNC and HND Electrical Engineering awards and Degree

programmes.

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Aim No How it is met in HNC and HND

3.2.4 The current HNC and HND Engineering awards contain separate Communication and Information Technology Applications

Units within their mandatory cores. The market research information gathered through various consultations indicates that there

continues to be solid support for the inclusion of a distinct Communication Unit in the mandatory core of the HNC and a

Communication and Information Technology Units within the mandatory core of the HND Engineering award. The benefit of

having separate Communication and Information Technology Units is that it significantly improves the prospect of sufficient

attention being given to the teaching of these two key subjects. Separate Units also make it possible to ensure that the

Communication and Information Technology core skills at Higher level are fully embedded within the respective Units within the

HND. Award designers considered this a more appropriate way to ensure that these core skills are included in HN Engineering

awards than trying to embed such core skills across, say, a range of engineering Units, except at HNC level where they believe

there is considerable opportunities to develop Information Technology Core Skills within Electrical Units. A number of

respondents to various surveys have expressed their concerns about Communication and Information Technology not being seen

as relevant by candidates because they are not delivered and assessed within an engineering context. The HNC/D Electrical

Development Team has addressed this concern by supporting the production of Communication and Information Technology

assessment exemplar materials specifically contextulised to engineering.

3.2.5 Market research shows that employers place a high priority on employees having the correct technical and practical skills to

function effectively in their job. Whilst there continues to be a debate about the precise nature of such technical and practical

skills it is clearly important that electrical technicians and incorporated engineers have a sound knowledge and understanding of

core electrical principles. Such knowledge and understanding will serve candidates well in employment and provide the platform

for learning more advanced technical skills. The Mandatory section of the new HNC Electrical Engineering award reflects this

concentration on core principles by providing studies in the key areas of Electrical Engineering namely: electrical principles,

electrical power systems, electrical machine principles and electrical safety. The HN Electrical Development Team also took the

view that a knowledge and understanding of Mathematics is fundamental to the work of electrical technicians and has included a

Mathematics Unit (containing the Using Number component of the Core Skill Numeracy at Higher level) within the Mandatory

section of the HNC Electrical Engineering award. The inclusion of Mathematics within the Mandatory section was widely

supported during various consultation processes.

3.2.6 The correct use of electrical and electronic instruments is very important to electrical technicians and incorporated engineers. The

Electrical Development Team regard such skills as so important that it has included a Unit on the use of electrical and electronic

instruments in the Mandatory section of the HNC.

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Aim No How it is met in HNC and HND

3.2.7 In the 2-credit optional section candidates will be able to specialise further in the following areas: Electrical Principles,

Information Technology, Three Phase Induction Motors, Power Electronics, Inspection and Testing of Low Voltage Electrical

Installations, Programmable Logic Controllers, Electrical Systems in Hazardous Environments, Control Systems, further

Mathematical studies, Electrical Installation Skills and Quality Management. The HN Electrical Development Team strongly

recommends that candidates with little or no practical electrical experience take the Electrical Installation Skills Unit as

part of their optional studies. Analysis of candidate uptake of Units in the optional section of the current HNC Engineering:

Electrical award revealed that many Units had low entry numbers. The HN Electrical Development Team took the view that

given the resources available for Unit development purposes, efforts should be concentrated on the development of optional Units

where there was a reasonable confidence of high candidate uptake. This explains why there are only a limited number of Units in

the optional section. Consultation with the FE sector and other stakeholders has indicated that the choice of Units in the optional

section is correct. One advantage of limiting the number of optional Units is that more attention has been given to these Units

resulting, in the view of the Development Team, in better quality Unit specifications.

The HN Electrical Development Team does not preclude additional Units being added to the optional section especially where

demand for such Units can be demonstrated.

3.2.8 The Communication Core Skill at Higher level has been incorporated into the HNC Electrical Engineering award through the

mandatory Unit, Communication: Practical Skills. There was strong support for the inclusion of the Numeracy core skill at

Higher within both HNC and HND Engineering awards. The Electrical Development Team has adopted the Unit Mathematics for

Engineering 1: Electronics and Electrical (taken from the HNC and HND Electronics awards). The Core Skill component Using

Number at Higher is embedded in this Unit. Opportunities to develop the Core Skills Information Technology, Problem Solving

and Working with Others are signposted within individual Unit specifications. Candidates may achieve the Information

Technology and Working with Others Core Skills at Higher level if they take the optional Units in Information Technology:

Applications Software 1 in the HNC and Employment Experience 2 within the HND, respectively.

3.4.1 See comments under 3.2.2 and 3.2.3.

Arrangements Document: HNC Electrical Engineering (G7TA 15) and HND Electrical

until Electrical Engineering Principles 2.

Table 5.6: Credit Transfer Opportunities (continued)

Existing

Unit No.

Existing Unit Title New Unit

No.

New Unit Title Level of Credit

Transfer

Comments

D5R4 04 Introduction to

Advanced Pattern

Development

DV9H 33 Advanced Pattern

Development: An

Introduction

100%

D4KD 04 Plant Systems:

Services

DW7M 34 Plant Systems:

Utilities

40% O.1 to O.3 in existing Unit — no equivalent

O.4 in existing Unit equivalent to O.3 on boilers in

new Unit.

O.5 in existing Unit equivalent to O.4 on

commissioning in new Unit

D4KC 04 Plant Systems:

Utilities

DW7N 34 Plant Systems:

Utilities

Plant Services:

Services

50%

25%

Pumps and fans and refrigeration systems common

O.2 Outcome on compressed air systems equivalent

to O.1 and O.2 on compressed air systems in

new Unit

O.4 on air-conditioning in old Unit — no equivalent

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Table 5.6: Credit Transfer Opportunities (continued)

New Unit Title New Unit

Code

Old Unit Title Old Unit

Code

Credit Transfer Conditions

Engineering Mathematics 1 H7K0 33 Mathematics for Engineering

1:Electronics and Electrical

DG4H 33 To gain credit transfer to the new unit candidates will

have to provide additional evidence relating to functions

as specified in the Evidence requirements in respect of

the first three knowledge/skills in Outcome 1 and

relating to vectors as specified in the first three

knowledge/skills in outcome 3.

Engineering Mathematics 1 H7K0 33 Mathematics for Engineering

1:Mechanical and Manufacturing

DT5X 33 To gain credit transfer to the new unit candidates will

have to provide additional evidence relating to functions

as specified in the Evidence requirements in respect of

the first three knowledge/skills in Outcome 1 and relating

to 3D vectors and complex numbers as specified in the

knowledge/skills in outcome 3.

Engineering Mathematics 2 H7K1 34 Mathematics for Engineering 2 DG4L 34 To gain credit transfer to the new unit candidates will

have to provide additional evidence relating to

trigonometric and hyperbolic functions as specified in

the Evidence requirements in respect of Outcome 1.

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6 Approaches to delivery and assessment

6.1 Delivery

As mentioned in Section 2.3 the QDT were firmly of the view that the PDA/HNC

Engineering Practice suite of awards are principally for candidates in employment

and would, therefore, normally be studied by candidates who attend a centre on a

day-release or other part-time basis. The PDA/HNC Engineering Practice award

structures are sufficiently flexible enough to allow centres to deliver the awards by

various modes of delivery for example, two-year day-release, evening attendance,

block-release etc.

Where centres decide to offer a PDA/HNC Engineering Practice on a full-time basis

it is strongly recommended that candidates are provided with opportunities to take a

number of practical engineering Units in conjunction with Units in the relevant

award structure so that they can acquire some useful practical skills and gain some

exposure to what it may be like working in a practical engineering environment (s).

Centres are also encouraged to arrange a number of industrial visits for their candidates so that they can see some applications of subjects learnt on their course in practical engineering environments.

With regard to timetabling centres may timetable a PDA and the HNC Engineering Practice in sequence (ie the six PDA Units first followed by the six HNC Engineering Practice Units) as illustrated in the first timetable for a PDA in Engineering Practice: Engineering Manufacture at SCQF level 7/HNC Engineering Practice in Appendix 1. Alternatively, centres may mix the timetabling of a PDA and HNC Engineering Practice Units to meet different candidate and employer needs as illustrated in the second timetable for the PDA in Engineering Practice: Electrical Engineering at SCQF level 7/HNC Engineering Practice in Appendix 1.

Centres should take account of information contained in the Recommended Prior Knowledge and Skills statements in Unit specifications in sequencing the delivery of Units (eg it would be normal to deliver the Electrical Engineering Principles 1 Unit before the Electrical Engineering Principles 2 Unit).

Centres, working on their own or in partnership, might also wish to consider the following approaches to delivering the PDA/HNC Engineering Practice awards:

¨ Identification and sharing of good candidate learning support materials on the internet

¨ Use of the Internet by candidates to undertake more in-depth investigations in given subject areas

¨ Development or purchase of paper based and/or electronic candidate learning support and assessment materials for individual Units (eg for certain optional Units)

¨ Development of on-line Unit and Graded Unit assessment materials

¨ Use of e-mentoring arrangements to support candidates who study at a distance

One of the key reasons the QDT has sought to reduce the time candidates have to

spend on summative Unit assessment is to provide lecturers with more time to deliver Units. Lecturers are encouraged, in particular, to use this additional time to reinforce learning in core engineering and supervisory concepts and principles and in the transfer of knowledge, understanding and skills across subject boundaries.

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Lecturers may use a variety of teaching and learning approaches in delivering the Units in the PDA/HNC Engineering Practice awards. These may include lecturing, group work, laboratory and practical work, computer simulation (using appropriate software packages), project work and case studies. The use of open and distance learning and on-line materials may help to supplement and support the learning that takes place in the classroom, laboratory or workshop.

Lecturers should also seek opportunities to integrate Core Skills within their teaching and learning programmes. Such opportunities may include the following: -

Communication

¨ Providing candidates opportunities to develop their oral skills by allowing them to give full answers to questions asked by the lecturer

¨ Developing complex, vocationally specific reading skills (eg Communication: Practical Skills.)

¨ Developing report writing skills in a number of Units (eg Computer Aided Manufacture, Value Engineering)

¨ Allowing candidates to develop their Communication skills in group work activities (eg Communication: Practical Skills, Engineering Supervision: Teamworking and Continuing Professional Development)

Numeracy

¨ Reinforcing Numeracy and Mathematical skills when teaching engineering principles (eg Mechanical Engineering Principles, Electrical Engineering Principles 1, Electrical Engineering Principles 2)

¨ Reinforcing Using Graphical Information skills by use of a range of graphical representations (eg Electrical Installation Design (Computer Aided): An Introduction, Containers: Design and Manufacture)

Information and Communication Technology

¨ Develop Information and Communication Technology skills through the application of IT within engineering systems (eg Computer Aided Draughting for Engineers, Quality Management: An Introduction)

Problem Solving Skills

¨ Develop Critical Thinking Skills through the application of engineering concepts and principles to solve engineering systems (eg Lighting Design in Buildings, Value Engineering)

¨ Develop Planning and Organisational Skills within an engineering and supervisory context (eg Industrial Plant Maintenance, Engineering Supervision: Teamworking and Continuing Professional Development)

¨ Develop review and evaluation skills within an engineering and supervisory context (eg Inspection Systems, Value Engineering)

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Working with Others

¨ Develop Working with Others skills through identifying approaches to developing high performance team and group discussions on the solution to engineering problems (eg Engineering Supervision: Teamworking and Continuing Professional Development, Containers: Design and Manufacture)

Opportunities for candidates to develop some Core Skills components as part of the delivery of PDA mandatory Units are identified in Table 6.1(a). Likewise Core Skill component development opportunities within the HNC Engineering Practice are shown in Table 6.1(b). Centre staff are asked to refer to individual optional Unit specifications for details of other PDA/HNC Engineering Practice Core Skill

component development opportunities.

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Table 6.1(a) PDA — Core Skills development opportunities in mandatory Units

Note: CT = Critical Thinking: P and O = Planning and Organisation and R and E = Reviewing and Evaluating

Unit Title Communication Numeracy Information and

Communication

Technology

Problem Solving Working with

Others

Read Write Oral Using

Number

Using

Graphical

Inform.

Using

Information

Technology

CT P and O R and E Working with

Others

PDA in Engineering

Practice: Fabrication

and Welding

Welding Principles and

Applications 1

Higher Higher Higher Higher

Containers: Design and

Manufacture

Higher Higher Higher Higher Higher Higher Higher Higher Higher Intermediate 2

Inspection Systems Higher Higher Higher Higher Higher Higher

Fabrication: Steelwork

Preparation, Joining and

Assembly

Higher Higher Higher Higher

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Table 6.1(a) PDA — Core Skills development opportunities in mandatory Units (continued)

Unit Title Communication Numeracy Information and

Communication

Technology

Problem Solving Working with

Others

Read Write Oral Using

Number

Using

Graphical

Inform.

Using Information

Technology

CT P and O R and E Working with

Others

PDA in Engineering

Practice: Engineering

Manufacture

Mechanical Engineering

Principles

Int. 2 Int. 2 Int. 2

Computer Aided

Draughting for

Engineers

Higher

CNC Int. 2 Higher Higher

Engineering

Measurement

Higher

PDA in Engineering

Practice: Engineering

Maintenance

Plant Systems: Service Higher Higher Higher

Plant Systems: Utilities Higher Higher

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Table 6.1(a) PDA — Core Skills development opportunities in mandatory Units (continued)

Unit Title Communication Numeracy Information and

Communication

Technology

Problem Solving Working with

Others

Read Write Oral Using

Number

Using

Graphical

Inform.

Using Information

Technology

CT P and O R and E Working with

Others

PDA in Engineering

Practice: Engineering

Maintenance

(continued)

Mechanical Engineering

Principles

Int. 2 Int. 2 Int. 2

Industrial Plant

Maintenance

Higher Higher Int.2 Int. 2 Higher Higher Higher Int. 1

PDA in Engineering

Practice: Electrical

Engineering

Electrical Engineering

Principles 1

Int.2 Int.2

Electrical Engineering

Principles 2

Higher Higher

Applications of

Electrical and Electronic

Instruments

Higher Int.2 Int.2 Int.2 Int.2

Electrical motors and

motor starting

Int. 2 Higher

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Table 6.1(b) HNC Engineering Practice — Core Skills development opportunities in mandatory Units

Note: CT = Critical Thinking: P and O = Planning and Organisation and R and E = Reviewing and Evaluating

Unit Title Communication Numeracy Information and

Communication

Technology

Problem Solving Working with

Others

Read Write Oral Using

Number

Using

Graphical

Inform.

Using

Information

Technology

CT P and O R and E Working with

Others

Communication: Practical

Skills

Higher

Embed

-ded

Higher

Embed

-ded

Higher

Embed

-ded

Engineering Supervision:

Team working and

Continuing Professional

Development

Higher Higher Higher Higher Higher Higher Higher

Quality Management: An

Introduction

Higher Higher Higher Higher

Value Engineering Higher Higher Higher Higher Higher Higher

Engineering Practice:

Graded Unit 1

Higher Higher Higher Higher

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6.2 Assessment

6.2.1 Introduction

From the outset of developments the QDT recognised the need to have an appropriate assessment strategy in place for the Advanced Certificate/HNC Engineering Practice (now re-titled PDA/HNC Engineering Practice) awards. Such a strategy was developed and is shown below:

Aims

The aims of the strategy are to ensure that:

1 consistent, rigorous and efficient approaches are adopted to the development and administration of PDA/HN Engineering Practice assessment instruments at both Unit and Graded Unit levels, which satisfy nationally agreed standards;

2 the assessment load on candidates and staff is sensible and that assessment does not unduly detract from teaching and learning;

3 as far as possible reliable and rigorous moderation processes are put in place in order to ensure that consistent national standards are achieved for all PDA/HNC Engineering Practice assessments.

Objectives

Listed below are the measures that have been put in place to meet the aims:

1 Develop nationally one assessment exemplar pack for the mandatory Units in each of the PDA and the HNC Engineering Practice that clearly sets out the standards of assessment expected in Units.

2 Adopt a holistic approach to Unit assessment. The implications of this are as follows:

i Assessment instruments will normally be designed only to sample knowledge and skills in a Unit (this is consistent with the new HN Unit format)

ii A Unit assessment strategy will be adopted, where possible, to produce a single assessment instrument for the whole Unit. Where this is not possible the assessment strategy will seek to ensure that the minimum number of assessment instruments is required consistent with maintaining agreed national standards.

3 Whilst not seeking to be entirely prescriptive with regard to the time spent on assessment in each HN Unit, over assessment should be avoided if the following guideline is adopted for the maximum time spent on HN Unit assessment:

One and a half hours per Unit credit for HN Units at SCQF levels 6 and 7 and two hours per Unit credit for HN Units at SCQF level 8.

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4 Produce assessment exemplar packs for the Graded Unit. In addition, for the Graded Unit examination produce at least one sample exam paper to show the standards expected in such a paper

5 Actively encourage centres to work in partnership in producing Graded Unit assessment materials, which meet nationally agreed standards reducing, in turn, the workload on staff in individual colleges.

6 Ensure that consistent and rigorous internal and external moderation procedures operate through both HN Unit level and Graded Unit assessment processes.

This places a clear responsibility on both centres and the SQA.

As far as has been practical the above objectives have been adhered to when developing assessment exemplar and Graded Unit materials.

6.2.2 Graded Units

The purpose of the Graded Unit within the PDA/HNC Engineering Practice award structure is to assess the candidate's ability to apply and integrate knowledge and/or skills gained within individual Units. By this means candidates will demonstrate that they have achieved the aims of the awards as detailed in Section 3. The Graded Unit also provides the means by which candidate achievement can be graded.

PDA/HNC Engineering Practice candidates will undertake a one credit Graded Unit at SCQF level 7. This will be in the form of a 3-hour written examination.

Engineering Practice: Graded Unit 1 — Examination

The specifications for the Engineering Practice: Graded Unit 1 can be found on the SQA website (www.sqa.org.uk). The Graded Unit draws on the Outcomes in the mandatory sections of the relevant PDA and the HNC Engineering Practice award.

The examination paper consists of the following two sections:

Section A;

Section B.

Section A should be subdivided into up to four individual sub-sections to reflect the four different engineering disciplines candidates may have studied at PDA level: namely Fabrication and Welding, Engineering Manufacture, Engineering Maintenance and Electrical Engineering. Each sub-section should comprise of a suitable balance of between 8 to 12 short answer, restricted response and structured questions. Candidates should answer all questions in the relevant sub-section of Section A. Candidates should be able to score up to a maximum of 50% from the sub-section they have answered questions from.

Section B should comprise of a Case Study based around the HNC Engineering Practice mandatory Units in which candidates have to answer questions on appropriate engineering supervisory issues and problems. All candidates, irrespective of which engineering discipline they have studied at PDA level, should answer all questions in Section B. The question paper associated with the Case Study should comprise of between 6 and 10 restricted response questions. Candidates should be able to score a maximum of 50% from Section B. Candidates

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should be given a copy of the Case Study only, a minimum of 14-days before they sit the examination.

The examination should be conducted under closed-book, supervised conditions with candidates only being allowed to bring into the examination up to 3 sides of A4 hand written notes they have prepared on the Case Study. These notes should be handed to the invigilator at the end of the examination. Candidates should be allowed to bring a scientific calculator into the examination.

It is recommended that candidates do not sit the Graded Unit examination until the end of the PDA/HNC Engineering Practice programme of study given the range of

Units that the Graded Unit draws on.

6.2.3 Assessment Exemplar Materials

Assessment exemplar packs have been produced for the following mandatory Units in the four PDAs and HNC Engineering Practice award.

DR2G 34 Welding Principles and Applications: 1

DR23 34 Containers: Design and Manufacture

DR26 34 Inspection Systems

DR26 34 Fabrication: Preparation, Joining and Assembly

DV9G 34 Mechanical Engineering Principles

DR1X 34 Computer Aided Draughting for Engineers

DT5P 34 CNC

DT9R 34 Engineering Measurement

DW7M 34 Plant Systems: Services

DW7N 34 Plant Systems: Utilities

DN40 34 Industrial Plant Maintenance

DW6W 33 Electrical Engineering Principles 1

DW6X 34 Electrical Engineering Principles 2

DN48 33 Application of Electrical and Electronic Instruments

DV9M 34 Electrical Motors and Motor Starting

D77G 34 Communication: Practical Skills

DW71 34 Engineering Supervision: Teamworking and Continuing Professional Development

DT8Y 34 Quality Management: An Introduction

DW7K 34 Value Engineering

An assessment exemplar pack and an additional sample examination paper have been produced for DW92 34 Engineering Practice: Graded Unit 1.

6.2.4 Formative Assessment

Formative assessment should be used throughout the delivery of Units to reinforce learning, build candidates' confidence and prepare candidates for summative assessment.

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6.3 Resources

Practical Resources

Centre staff are advised to read individual Unit specifications carefully to identify the consumables, equipment and/or software requirements to deliver Units. Some Units have specific requirements. For example, the Computer Aided Draughting in Engineering and Electrical Installation Design (Computer Aided): An Introduction require candidates to use industrially specific software. The Computer Integrated Manufacture Unit requires candidates to be able to access CNC equipment.

While not all Units require practical resources, centres are strongly recommended to provide candidates with access to practical workshop facilities appropriate to the particular PDA. For example, candidates undertaking the PDA in Engineering Practice: Fabrication and Welding at SCQF level 7 should have access to practical fabrication and welding facilities. Such access will allow candidates to relate the theory they are being taught to practice.

When teaching subjects such as pumps, fans, electrical motors etc centres should allow candidates to view disassembled equipment so that they can gain a greater appreciation of the construction of these items of plant. A good chart or other visual aid showing the various parts of an item of plant can also be a very good teaching aid.

The QDT strongly recommend the use of simulation software to support teaching and learning. However, the Team do not believe that such software should be used at the expense of practical workshop and laboratory activities. The Team strongly considers that such practical activities represent the best way for candidates to relate

the theory they learn in the classroom to practical engineering.

The QDT believe that there is a very rich and varied range of teaching and learning resources available to deliver individual PDA and HNC Engineering Practice Units. Such learning resources include textbooks, reports, papers, standards, CDs, DVDs and numerous sites on the Internets. Some centres may already have good learning resources in their learning libraries/Virtual Learning Environments. It is anticipated that the Qualification Support Team (QST) for the PDA/HNC Engineering Practice will provide a useful forum for the identification and sharing of learning resources.

Continuing Professional Development

The QDT are firmly of the view that active staff CPD is essential if the delivery and assessment of individual PDAs and HNC Engineering Practice Units are to be kept up to date, relevant and interesting. Staff CPD activities could be in subject areas such as the following (the list is not intended to be exhaustive):

¨ Learning to use specialist engineering software

¨ Modern manufacturing methods

¨ New or revised standards and regulations

¨ Issues relating to health and safety

¨ Quality Control and Quality Assurance

¨ Value Engineering

¨ New teaching and assessment methodologies

¨ E-learning

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6.4 Open and Distance Learning

Advice on the use of open and distance learning is given in individual Unit specifications. However, where it is used with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangement would be required to be put in place to ensure that

the assessment or assessments were conducted under the conditions specified in the Unit specification. For example, in the case of a Unit which involved a Unit end test a centre would have to make arrangements for the test to be conducted under controlled, supervised conditions. Likewise, where a Unit involves a practical based assessment, a centre would have to make arrangements for candidates to come into the centre, or another appropriate venue, to undertake the assessment under the conditions specified in the Unit specification.

It should be noted that the same requirements as specified in the previous paragraph apply where part or all of a Unit is delivered on-line.

7 General information for centres

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs (www.sqa.org.uk).

Internal and external moderation

All instruments of assessment used within this/these Group Award(s) should be internally moderated, using the appropriate policy within the centre and the guidelines set by SQA.

External moderation will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

Further information on internal and external moderation can be found in SQA's Guide to Assessment (www.sqa.org.uk).

8 General information for candidates

The new Professional Development Award (PDA)/HNC Engineering Practice awards have been designed by an expert team of educators and industrialists with a

view to allowing you to meet the educational and training requirements to work as an advanced craftsperson and engineering supervisor. The new qualifications contain up-to-date and relevant engineering and supervisory subject content and skills and have also been designed to satisfy the new SQA PDA/Higher National Design Principles.

The PDA/HNC Engineering Practice award structure consists of four, 6-credit PDAs in Fabrication and Welding or Engineering Manufacture or Engineering Maintenance or Electrical Engineering. Each of these four PDAs is at SCQF level 7. You should choose to study the PDA which best meets your employment and

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educational requirements. Regardless of which PDA you study, you will, along with other candidates, study the single 6-credit HNC Engineering Practice. To obtain a PDA you must successfully achieve the 6-credits in the relevant PDA award framework. To achieve an HNC Engineering Practice you must achieve a PDA and the 6-Unit credits in the HNC Engineering Practice.

Studying a PDA will allow you to develop your knowledge, understanding and skills in your chosen advanced engineering craft discipline. Each PDA consists of a 4-credit mandatory section and an optional section where you can choose two Unit credits from a range of Units to suit your employment and education needs. The mandatory sections of the four PDAs contain the subjects shown in the table below:

PDA Subjects in Mandatory section

PDA in Engineering Practice:

Fabrication and Welding at SCQF

level 7

Welding principles and applications,

container design and manufacture,

inspection systems and fabrication

steelwork preparation, joining and
assembly
PDA in Engineering Practice:
Engineering Manufacture at SCQF level
7
Mechanical engineering principles, CAD,
CNC and engineering measurement
PDA in Engineering Practice:
Engineering Maintenance at SCQF
level 7
Plant Systems: services and utilities,
mechanical engineering principles and
industrial plant maintenance.
PDA in Engineering Practice:
Electrical Engineering at SCQF level 7
Electrical principles, applications of
electrical and electronic instruments and
electric motors and motor starting

In the HNC Engineering Practice you will be provided with opportunities to develop much of the knowledge, understanding and skills to become an engineering supervisor. Five Unit credits in the HNC Engineering Practice are mandatory. These Units are Communication: Practical Skills, Engineering Supervision: Teamworking and Continuing Professional Development, Quality Management: An introduction, Value Engineering and the Engineering Practice examination. You will be able to choose one Unit in the HNC Engineering Practice from the following options: Mathematics (with either an electrical or mechanical bias), further supervisory studies in staffing and budget control, Production Planning and Control, Workplace

Communication in English or Personal Development Planning.
The teaching and learning processes that your lecturers are likely to use on a PDA/HNC Engineering Practice are as follows: lecturing, group work, practical engineering work, measurement and testing, computer simulation and project work. Industrial visits may also be included in your programme of study to allow you to see 'real life' engineering in action.
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The Qualifications Design Team has ensured that assessment in the awards meet national standards. The awards have been designed to optimise assessment so that sufficient time is available for you to learn the advanced engineering craft and supervisory knowledge and skills that are essential to being a good craft/trades person and engineer supervisor.
You can expect to do assessment at individual Unit level and at qualification level. At Unit level assessments will normally consist of written tests and/or practical exercises which will include the preparation of reports. Your lecturer should tell you at the start of the Unit what form Unit assessment(s) will take. In addition to Unit assessment there will also be a 3-hour examination. This examination will be designed to assess you on your knowledge, understanding and skills in your chosen advanced craft area and in the HNC Engineering Practice award. You should ask your lecturer for more details about the composition of the examination paper and when you will sit it.
The Qualification Design Team does not wish to place any artificial barriers in the way of potential candidates wanting to study a PDA/HNC Engineering Practice award. However, it would be unfair to enrol a candidate into a PDA/HNC who did not have a realistic chance of successfully achieving the awards. The Qualification Design Team would therefore recommend that a candidate had one of the following qualifications before entering a PDA/HNC Engineering:

1 One Higher from Physics, Technological Studies or Mathematics and at least three Standard Grades 1–2/Intermediate 2 passes including Mathematics, Physics/Technological Studies and English.

2 An appropriate National Certificate in Engineering Practice or Engineering or an appropriate National Certificate in Engineering at SCQF level 5.

3 Equivalent qualifications or experience to those shown in (1) and (2).

On completion of your PDA/HNC Engineering Practice award there may be opportunities for you to progress to a 'Higher National technician qualification' in, say, Mechanical or Electrical Engineering if that is what you prefer to do. Your PDA/HNC Engineering Practice qualification should provide you with some credit transfer opportunities towards the 'technician HNC/HND.' The precise nature of credit transfer will depend on the HNC/HND you decide to study.

Alternatively, on completion of your PDA/HNC Engineering Practice award, you may decide to study a supervisory or management qualification. Many centres offer such qualifications and you are advised to obtain further information from centres on the range of supervisory or management qualifications they offer.

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9 Glossary of terms

SCQF: This stands for the Scottish Credit and Qualification Framework, which is a new way of speaking about qualifications and how they inter-relate. We use SCQF terminology throughout this guide to refer to credits and levels. For further information on the SCQF visit the SCQF website at www.scqf.org.uk

SCQF credits: One HN credit is equivalent to 8 SCQF credit points. This applies to all HN Units, irrespective of their level.

SCQF levels: The SCQF covers 12 levels of learning. HN Units will normally be at levels 6–9. Graded Units will be at level 7 and 8.

Subject Unit: Subject Units contain vocational/subject content and are designed to

test a specific set of knowledge and skills.

Graded Unit: Graded Units assess candidates' ability to integrate what they have learned while working towards the Units of the Group Award. Their purpose is to add value to the Group Award, making it more than the sum of its parts, and to encourage candidates to retain and adapt their skills and knowledge.

Dedicated Core Skill Unit: This is a Unit that is written to cover one or more particular Core Skills, eg HN Units in Information Technology or Communications.

Embedded Core Skills: This is where the development of a Core Skill is incorporated into the Unit and where the Unit assessment also covers the requirements of Core Skill assessment at a particular level.

Signposted Core Skills: This refers to the opportunities to develop a particular Core Skill at a specified level that lie outwith automatic certification.

Qualification Design Team: The QDT works in conjunction with a Qualification Manager/Development Manager to steer the development of the HNC/D from its inception/revision through to validation. The group is made up of key stakeholders representing the interests of centres, employers, universities and other relevant organisations.

Consortium-devised HNCs and HNDs are those developments or revisions undertaken by a group of centres in partnership with SQA.

Specialist single centre and specialist collaborative devised HNCs and HNDs are those developments or revisions led by a single centre or small group of centres who provide knowledge and skills in a specialist area. Like consortium-devised HNCs and HNDs, these developments or revisions will also be supported by SQA.

10 Appendix

Appendix 1: Sample Teaching Timetables

See following pages for Appendix 1.

Appendix 1: Sample Teaching Timetables

1 Two year part-time PDA in Engineering: Engineering Manufacture at SCQF level

7/HNC Engineering Practice

2 Two year part-time PDA in Engineering: Electrical Engineering at SCQF level

7/HNC Engineering Practice

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Two Year, Part-Time PDA in Engineering Practice: Engineering Manufacture/HNC Engineering

Practice

First Year, First Semester

Mechanical Engineering

Principles

Computer Aided Draughting

for Engineers

Options 1 (from the PDA in

Engineering: Engineering

Manufacture options)

First Year, Second Semester

Engineering Measurement CNC Options 2 (from the PDA in

Engineering: Engineering

Manufacture options)

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Two Year, Part-Time PDA in Engineering Practice: Engineering Manufacture/HNC Engineering

Practice (cont.)

Second Year, First Semester

Communication: Practical Skills Engineering Supervision: